Utah Department of Environmental Quality
Division of Water Quality

NONPOINT SOURCE MANAGEMENT PLAN FOR ABANDONED MINES IN UTAH

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Contents

Contents Continued

List of Figures

I. INTRODUCTION

Utah's Mining Nonpoint Source Management Plan is partially adapted from the plan used by the State of Colorado. The following topics are addressed in this plan: background information in regard to NPS pollution from abandoned mines in Utah, Utah's environmental setting, Utah's approach to nonpoint control for abandoned mines, best management practices, priorities and geographic perspective, goals and objectives, and implementation. The primary objective of this document is to outline a systematic approach for both identification and cleanup of surface and groundwater from abandoned metal mine sites in the state of Utah. This document will not address pollution from abandoned coal mines.

Abandoned mine sites present some of the most difficult challenges to water quality improvement in Utah, and the nation. This is due to the nature of the pollutants, and also to the difficult administrative, regulatory, and legal challenges involved with controlling the sources of pollutants, since neither water nor pollutants observe jurisdictional boundaries. Without intervention, most of these sites will not be returned to their pre-impact state. Natural processes alone will take decades or centuries to restore drastically disturbed mine sites, if restoration occurs at all. In addition, complications exist due to the lack of a Potentially Responsible Party[2] (PRP) that is inherent in the definition of an abandoned mine. Another complication is the remote location, high altitude and minimal infrastructure that often accompanies abandoned hardrock mining sites.

Given this setting, it is important to seek solutions that rely upon technologies that are practical for the locations and monetary resources available; and therefore, the nonpoint source mining program relies upon hydrologic controls and "passive" treatment technologies. Current treatment methods that may greatly reduce nonpoint source pollution problems associated with abandoned mines are outlined in the Best Management Practices section of this document.

According to the Utah Division of Oil, Gas and Mining (DOGM), between 17,000 and 20,000 abandoned mines exist in the State. Mining-related nonpoint source (NPS) pollution from abandoned mines in Utah is widespread and diverse and contributes to the impairment of numerous streams throughout the State. Under section 303(d) of the Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters on a biennial basis. Impaired waters are those water bodies that do not meet water quality standards set by their beneficial use designation even after point source limits have been met.

Figure 1. Columbus-Rexall acid mine drainage, Alta, UT.

[1] *For the purposes of this document, abandoned mine sites will be defined as a mined facility or site where there is no current mining activity and there is no identifiable owner, operator, or responsible party (40 CFR 122, CERCLA*

[2] *Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even our underground sources of drinking water. These pollutants include:1)Excess fertilizers, herbicides, and insecticides from agricultural lands and residential areas;2)Oil, grease, and toxic chemicals from urban runoff and energy production;3)Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks;4) Salt from irrigation practices and acid drainage from abandoned mines;5) Bacteria and nutrients from livestock, pet wastes, and faulty septicsystems;6) Atmospheric deposition and hydromodification are also sources of nonpoint source pollution.*

Figure 2. Bog Mine in Mineral Basin of American Fork Canyon, Utah County, UT

"Beneficial use" can be explained simply as the role a government—either local or national—chooses to have a water body fulfill. Therefore, section 303(d) requires that the state, territory, or tribe establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs) for these waters. A TMDL is essentially a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. Because abandoned mine-related pollution is considered nonpoint source, CWA Section 319 funding may be sought to clean-up and restore these impaired water bodies. A user's guide to the application and funding process for 319 monies is provided in Appendix G.

As an example of water body impairments due to abandoned mine-related sources, a scoping study conducted by the Western Governors' Association Mine Waste Task Force reported that Utah has 25,020 acres affected by abandoned mines, with an associated 83 miles of polluted streams (Durkin and Herrmann, 1994). Notably, most of the known mining-related NPS pollution in Utah results from abandoned metal mines. Mine drainage from abandoned coal mines is generally alkaline due to low-sulfur coals and abundant carbonate. As a result, coal mine drainage is relatively minor in comparison with abandoned metal mines. Additionally, cleanup of abandoned coal mines is currently being conducted under existing programs.

Potential Effects of Abandoned Mines

Pollution from hard-rock precious metal, base metal, and iron mining is created by digging up and moving tons of rock and soil and then separating the valuable metal from the rock through chemical treatment or smelting of the crushed material. This process usually generates large amounts of waste, the disposal of which can create several problems:

1. Heavy metal contamination can reduce soil productivity or sterilize the soil altogether. The absence of vegetation can make the site more susceptible to runoff, soil erosion, and potentially unstable ground.
2. Acid drainage containing acidity, iron, manganese, aluminum, and iron hydroxide and sulfuric acid can enter waterways and water supplies.
3. Alkaline runoff, high in salts and sediments, also occurs.
4. Blown dust and mine wastes are a source of air pollution.
5. Ruptures of dams, ponds, and impoundments can flood adjacent lands and discharge pollutants into waterways (Buck and Gerard, 2001).

Pollution From Uranium Mines

Abandoned uranium ore mines present unique challenges. In order to extract uranium, mills crush large quantities of rock and separate out the uranium. Stands of radioactive sand and slimes (referred to as mine wastes) are a by-product of this extraction and remain radioactive for hundreds of thousands of years. By 1978, the U.S. Government Accounting Office recorded 140 million tons of on-site mine waste piles at twenty-two abandoned and sixteen operational mills in the West. Continued production resulted in the addition of six to ten tons of mine waste per year (Grahame and Sisk, 2002).

Accidental releases of mine waste solutions into watercourses and runoff of rainwater from mine waste piles contribute to the contamination of surface water. The 40-year-old Atlas mill mine waste pile at Moab, Utah, located 750 feet from the Colorado River, covers 130 acres and leaks on average 57,000 gallons per day of contaminated fluids into the river (Grahame and Sisk, 2002). The radioactive isotopes that are released in the mining and milling process are slowly making their way downriver into the sediments and major surface water reservoirs of Lake Powell and Lake Mead.

Seepage from mine waste ponds and direct injection of wastes into the subsurface contribute to ground water contamination. Wells that tap into these aquifers provide much of the drinking and irrigation water for the arid Colorado Plateau and the Great Basin.

Mine waste piles threaten air quality in various ways. Radioactive dust from the piles is dispersed by wind. The piles produce radon gas, a deadly substance that has caused a five-fold increase in lung cancer among uranium miners. The use of mine waste as building and landfill materials was widespread throughout the 1950s and 1960s (Grahame and Sisk, 2002).

Implementation of Control Strategies

In response to the numerous effects of abandoned mine-related nonpoint source pollution, an appropriate control strategy should be identified and implemented. Examples of control strategy options are outlined in the Best Management Practices section of this document. Once a control strategy is determined for an affected stream segment, the next step is to determine how best to implement those activities to attain the goals. A number of regulatory, non-regulatory, voluntary, and incentive based approaches and programs are available for abandoned mine sites. These choices range from voluntary clean up efforts conducted by landowners, to issuance of various types of discharge permits, to Clean Water Act (CWA) Section 319 nonpoint source program grant assistance, to removal actions under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA).

The implementation of the strategies may combine these various program elements, or employ a limited number of these options, depending upon the needs and complexity of a particular stream segment or abandoned mining site.

Figure 3. Blackbird Mine (a cobalt mine on the Salmon-Challis NF) near Salmon, ID.

Examples of 319 Funded Projects

A handful of 319 funded projects are currently underway in Utah. As part of the TMDL for Little Cottonwood Creek, a remedial investigation, feasibility study, and implementation of passive mine discharge treatment have been conducted for the Columbus Rexall Mine drainage. Additionally, 319 monies are being used for abandoned mine related nonpoint source reduction in Mineral Basin of American Fork Canyon, and Silver Creek outside of Park City, UT.

Follow-up monitoring

Once implementation of the strategies have begun, it is important to monitor the results of the work performed to determine if the controls applied to the various sites are effective, and eventually, to monitor the stream segment to determine if the established goals are being attained. The time frames for improvements, both on site, and in stream are highly variable, and it is important to recognize that there may be a lag time between the implementation of controls and the realization of results.

Mining Technical Advisory Committee

The Mining Technical Advisory Committee (TAC) of the Utah Nonpoint Source Task Force has overseen the development of this plan. The TAC serves the State as both an advisor and purveyor of technical expertise in abandoned mining issues and will likely continue in this capacity beyond the development of this plan. The purpose of the committee is to advance efforts to protect and improve water quality, and facilitate the restoration of its beneficial uses, such as recreation, water supply, aquatic life and agriculture. The committee consists of non-governmental organizations, federal, state and local governments. Government agencies include: the U.S. Environmental Protection Agency, U.S. Forest Service, Bureau of Land Management, U.S. Geological Survey, Utah Division of Oil, Gas and Mining, Utah Geological Survey, Utah Division of Wildlife Resources, Utah Division of Water Quality, Salt Lake County Public Works Department, and Salt Lake City Public Utilities. Non-governmental entities include: the Utah Mining Association, Trout Unlimited, United Park City Mines, Kennecott Utah Copper, Snowbird Ski Corporation, and Alta Ski Lifts Corporation (Appendix F).

II. ENVIRONMENTAL SETTING

Mine Locations

Mining activities have had major impacts on both the environment and economic development of Utah. Seventy-five economically exploited minerals or commodities have been identified in Utah. Of these, 14 commodities (coal, copper, gold, silver, zinc, beryllium, gilsonite, potash, uranium, iron, lead, molybdenum, phosphate and salt) have made Utah a major mineral producer both nationally and internationally (Utah Mining Association, 2004). Mining activities have been conducted throughout the State. The most aerially extensive mining districts are located in the Colorado Plateau of southeastern Utah (Figure 9). Uranium, coal, and potash are the primary minerals in this area. Silver, gold, and numerous other precious minerals have historically been mined throughout northern Utah in the Wasatch Range and Great Basin (Figure 10). Three great districts, Bingham, Park City and Tintic, are especially notable for their size and production. Mercur, Gold Hill, Ophir and San Francisco are other important districts. Numerous abandoned mine sites—a small number of which impact surface and groundwater systems—remain throughout the State from both historical and recent activities. In addition, since metal mining operations are concentrated in areas with significant deposits of base and precious metals (e.g. gold, silver, lead, zinc and copper), background metal concentrations, as well as sulfur, arsenic and other potential environmentally harmful elements tend to also be high in these areas. In addition, shaft, adit, and prospect symbol mine working location data is available in a digital format from the Utah Division of Oil, Gas and Mining (Figure 11).

Figure 4. Mine near Gold Hill in western Tooele County, UT.

Geology

Mining-related water contamination is largely controlled by the geology of ore deposits and human development of the deposits. There are several maps and databases which can be combined to delineate areas of concern for mining-related water contamination caused by mining of various commodities. Several examples follow.

Uranium was mined extensively in the 1940s to 1980s from fluvial Triassic and Jurassic sandstones on the Colorado Plateau. Uranium-ore deposition was governed by ground-water circulation through ancient buried-stream channels in these sandstones that contained fossil organic material (Stokes, 1986). Potential uranium-related water problems can be delineated by overlaying uranium-mining district outlines and mine location point data onto a simplified geologic map which shows outcrops of the uranium-bearing sandstones (Figure 13).

Precious and Base Metals – gold, silver, lead, zinc, molybdenum, copper, and iron are typically associated with intrusive rocks intruded into older, usually Paleozoic, host rocks such as limestone or sandstone. These intrusives may, (1) contain metals (porphyry deposits), (2) directly mineralize intruded host rock (contact metamorphic deposits), or (3) mineralize intruded host rock through associated hot, mineral-laden fluids (hydrothermal deposits). Potential metal deposit-related water problems can be delineated by overlaying metals mining district outlines and mine location point data onto a simplified geologic map which shows granitic intrusive bodies (Figure 13).

Phosphate was deposited in Utah during the Mississippian and Permian Periods in restricted marine basins with low oxygen content which allowed organic material to be preserved. Phosphate is mined for the phosphorous content but typically contains significant quantities of uranium and metals like chromium, selenium, vanadium, and others. Idaho phosphate producers have experienced selenium pollution problems adjacent to their mines. Potential phosphate-related water problems can be delineated by overlaying mine location point data onto a simplified geologic map which shows outcrops of the phosphate-bearing stratigraphic units (Figure 13).

Black Shales were deposited in deep marine basins over a very long period of time ending in the Cretaceous Period. In most instances, the high organic content of the shales resulted in the concentration of metals in the shale; however, not all shales in Utah contain high metals concentrations. These shale were only occasionally mined as a raw material for clay brick manufacture. Black shale may affect background concentrations of metals in mining districts. Potential elevated metal concentrations can be delineated by overlaying mine location point data onto a simplified geologic map which shows outcrops of the carboniferous shales (Figure 13).

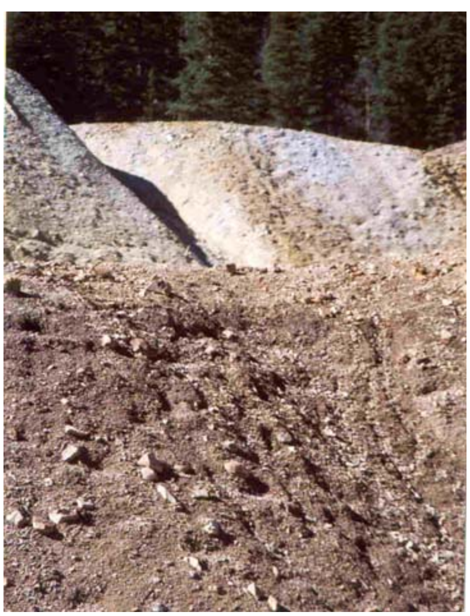


Figure 5. Mine waste pile in Alta, UT.

Figure 6. *Griffon Mine, after reclamation, near Ely, Nevada on Humboldt-Toiyabe NF.*

<u>Precipitation</u>

Mean annual precipitation in Utah (Figure 14) varies from less than 5 to over 65 inches per year. The majority of the western and southeastern portions of the State receive minimal precipitation (less than 10 inches per year), whereas, the central mountainous region of the State may receive upwards of 65 inches annually (Spatial Climate Analysis Service, 2000). Mean annual precipitation may be used as a key component when identifying areas to target for cleanup of nonpoint source pollution from mining related impacts.

<u>Rivers and Streams</u>

Notably, major waterbodies in Utah are also concentrated in the central and northeastern regions of the state, although, several large rivers are located in the southeastern portion of the State (Figure 15). Intermittent flow areas—delineated by light blue lines—are found throughout Utah. Although some areas receive minimal precipitation, metals and radioactive constituents may infiltrate surface and groundwater systems statewide through intermittent flow channels. The location of these flow channels may therefore assist in the identification of remediation sites.

Figure 7. Abandoned mine in Sheeprock Mountains south of Vernon in Tooele County, UT.

In addition to stream and river locations, existing stream and lake assessment data is a vital component of identifying abandoned mine sites. The Utah Division of Water Quality compiles impairment data annually (Figure 16 and Figure 17), which may be used to prioritize restoration activities.

Elevation and Topography

Similar to the distribution of precipitation, Utah has great disparity in regard to elevation (Figure 18). Two mountain ranges (Wasatch and Uintah) dominate Utah's topography. The Wasatch mountain range is north-south-trending. Mount Nebo, at 11,928 feet (3,636 meters), is located just east of the town of Nephi, and is the highest peak in the Wasatch Range. Alternately, the Uintah mountain range is east-west-trending and contains Kings Peak [13,528 feet (4,124 meters)], which is the highest peak in Utah (Milligan, 2000). In contrast, the majority of the western and southeastern regions of the State have elevations less than 4,300 feet (~1,300 meters). Because steep slopes may facilitate pollution dispersal, the topography of the State is extremely valuable when determining potentially contaminated sites.

Land Use/Ownership

Federal and State agencies own approximately 73% of land in Utah (Loomis, 2002). As can be seen in Figure 19, the Bureau of Land Management (BLM) manages the majority of lands in the western and eastern regions of the State. Private land is concentrated in the central and northcentral regions of the State; National Forest Service (NFS) land is also concentrated in this central area. The majority of National Park Service (NPS) land is found in Utah's southeastern desert and several Native American Reservations are located in the eastern portion of the State. Land ownership is a necessary component of any mitigation plan and will be used to determine both present and previous use of land parcels throughout Utah.

Vegetation

Dominant vegetation may be a useful surrogate for both soil and hydrology. Consistent with precipitation and elevation data, Figure 20 shows that Herb-Shrub and Grasses/Sedges plant communities dominate the western and southeastern portions of the state; whereas, Conifer-Aspen and Mountain Brush communities dominate the central and northeastern mountainous regions.

Figure 8. *Mine waste rock site in Sheeprock Mountains south of Vernon in Tooele County, UT.*

Geographic Information System (GIS) Layers

Statewide mining location, geology, hydrology, elevation, land status, and vegetation data in a digital format may be combined in a Geographic Information System (GIS) model to aid in identifying potentially polluted sites.

Figure 9. Mining districts and type in Utah

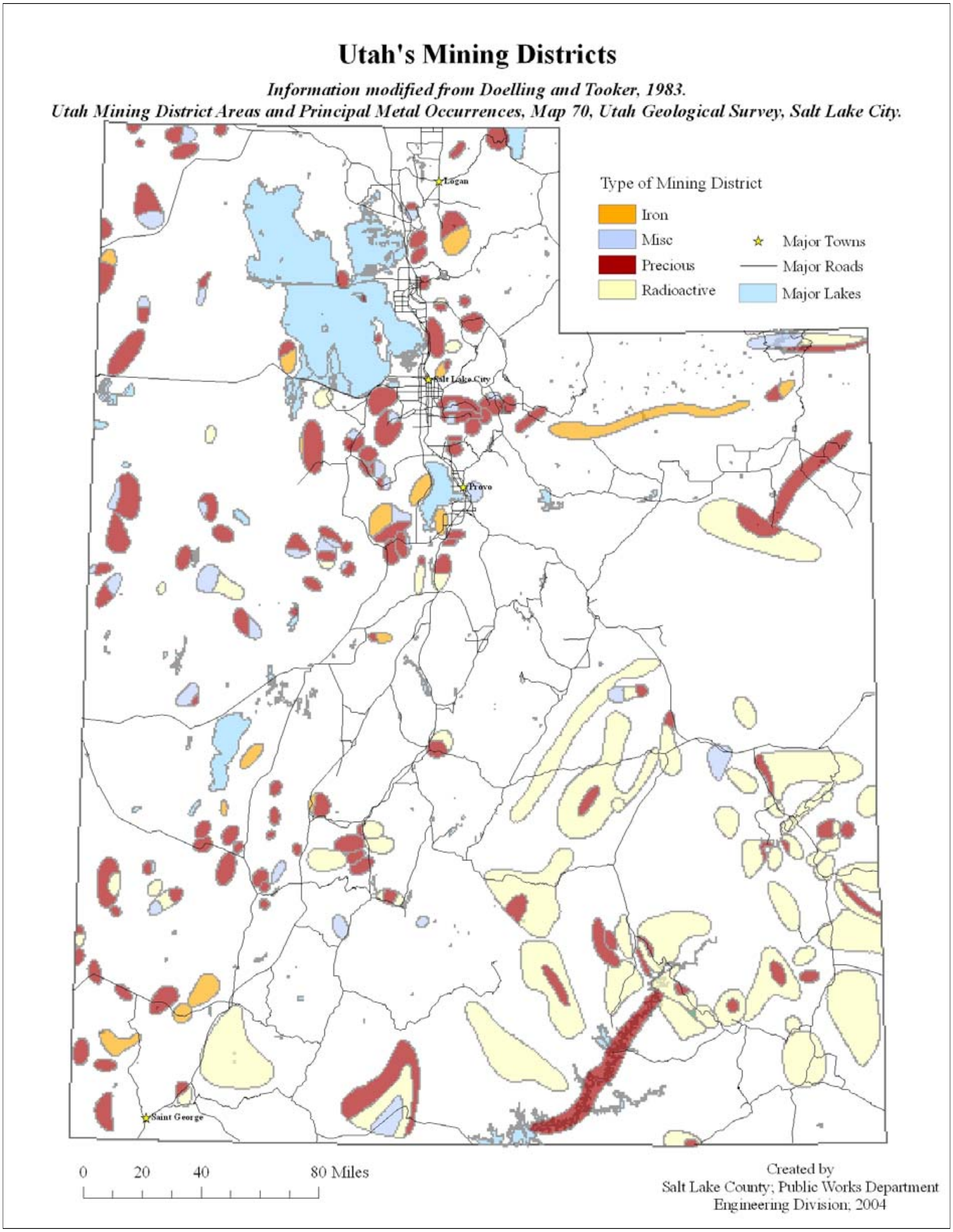


Figure 10. Mining occurrences in Utah.

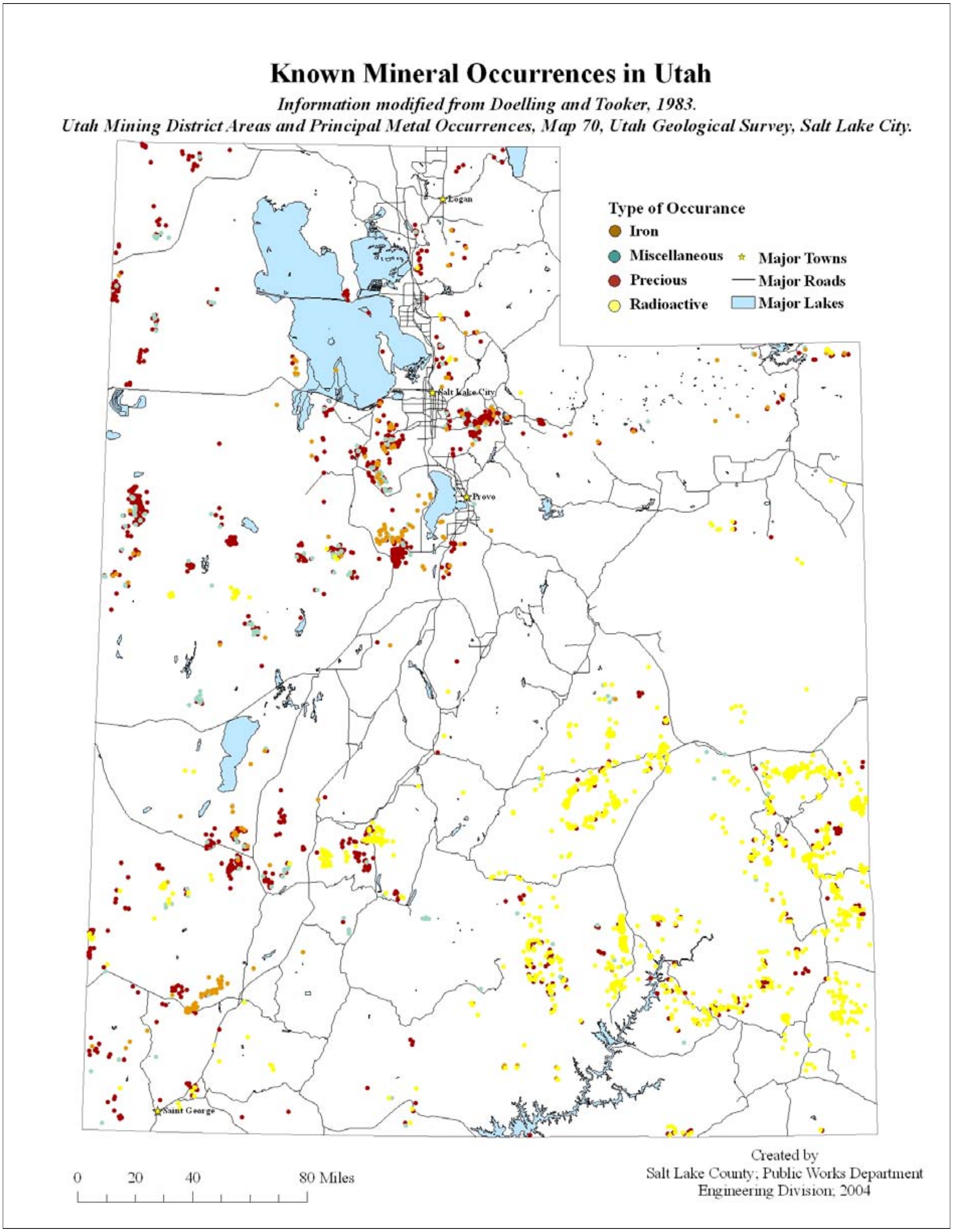


Figure 11. Shafts, adits, and prospect symbols.

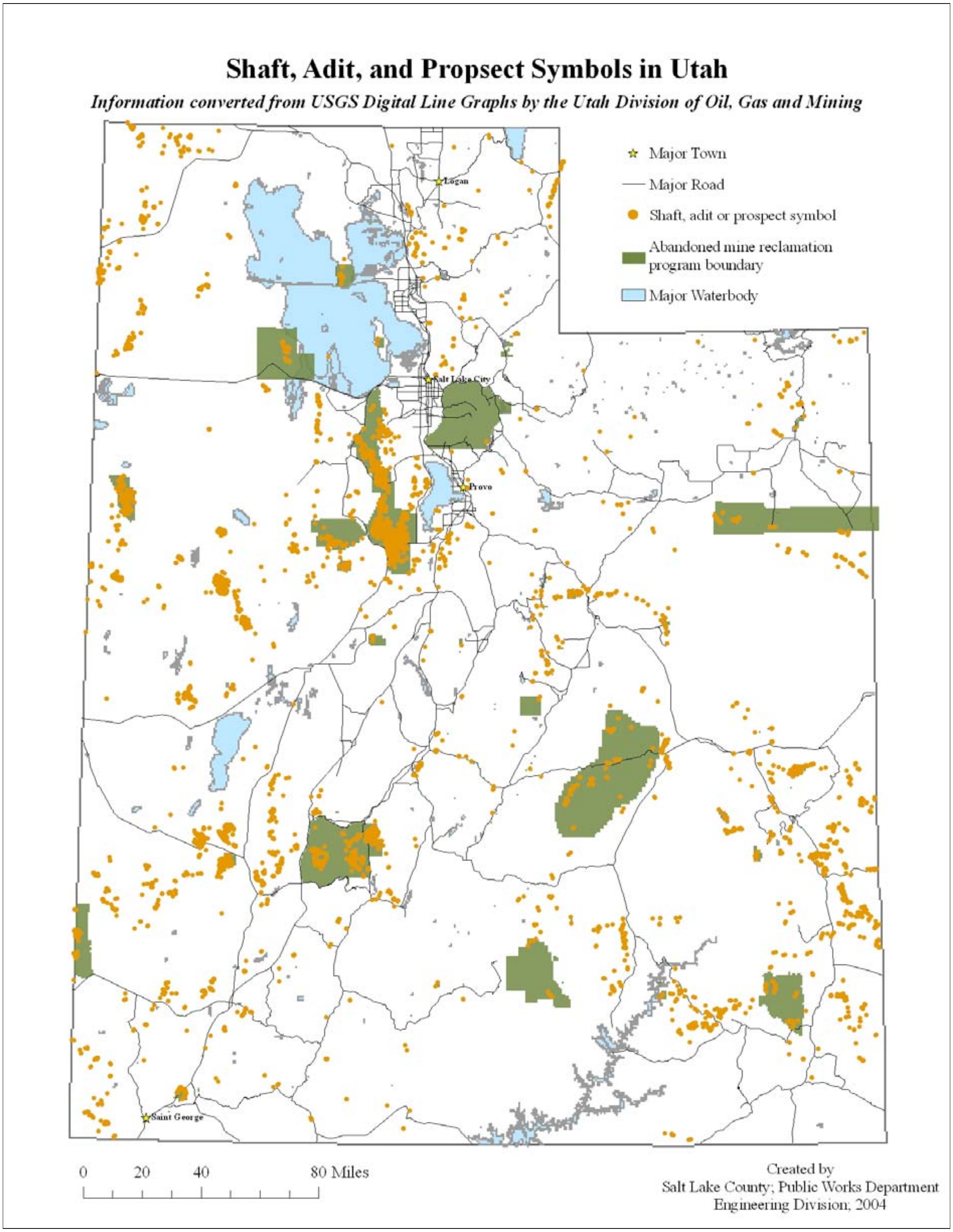


Figure 12. Utah's Geology

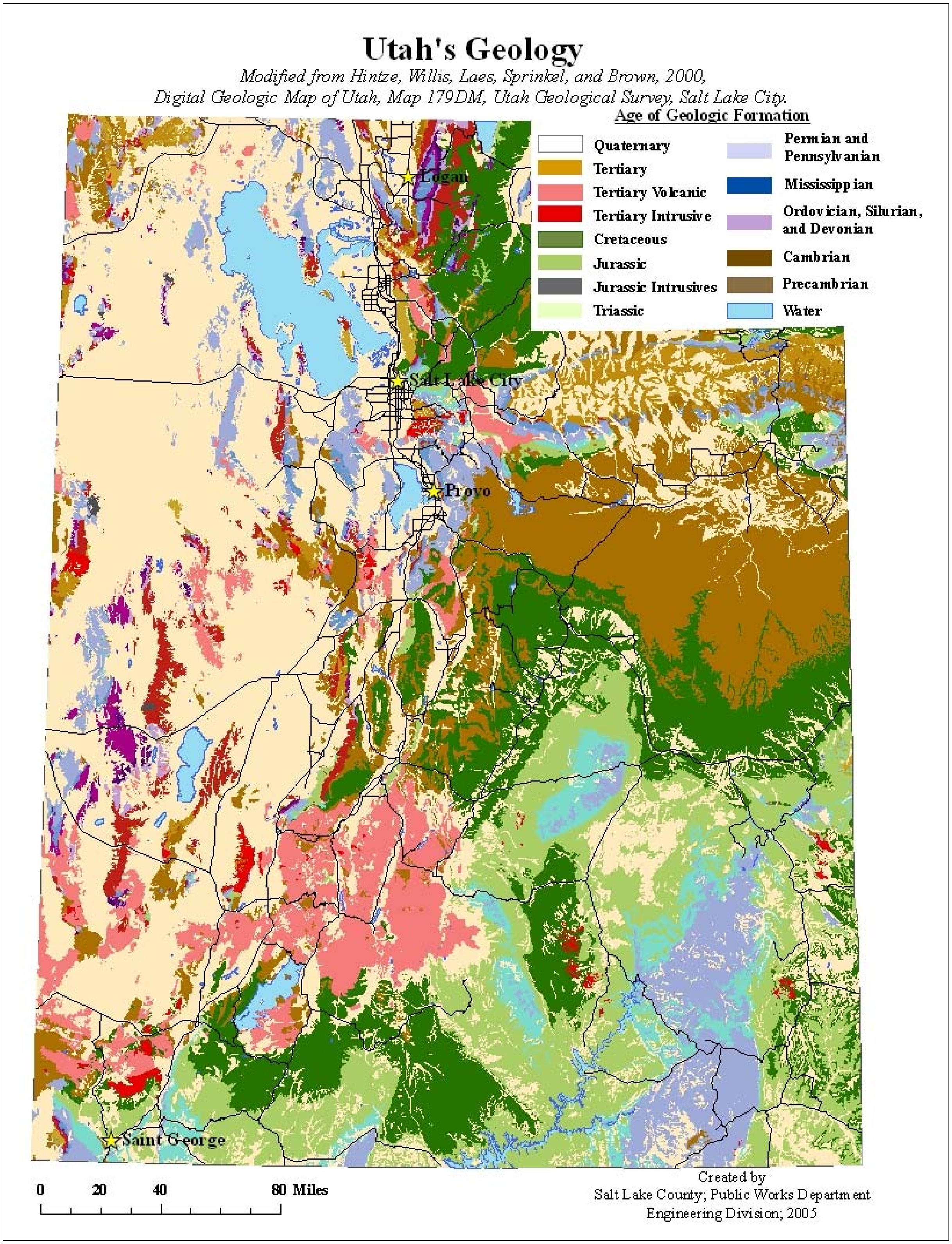


Figure 13. Areas of Geologic Concern

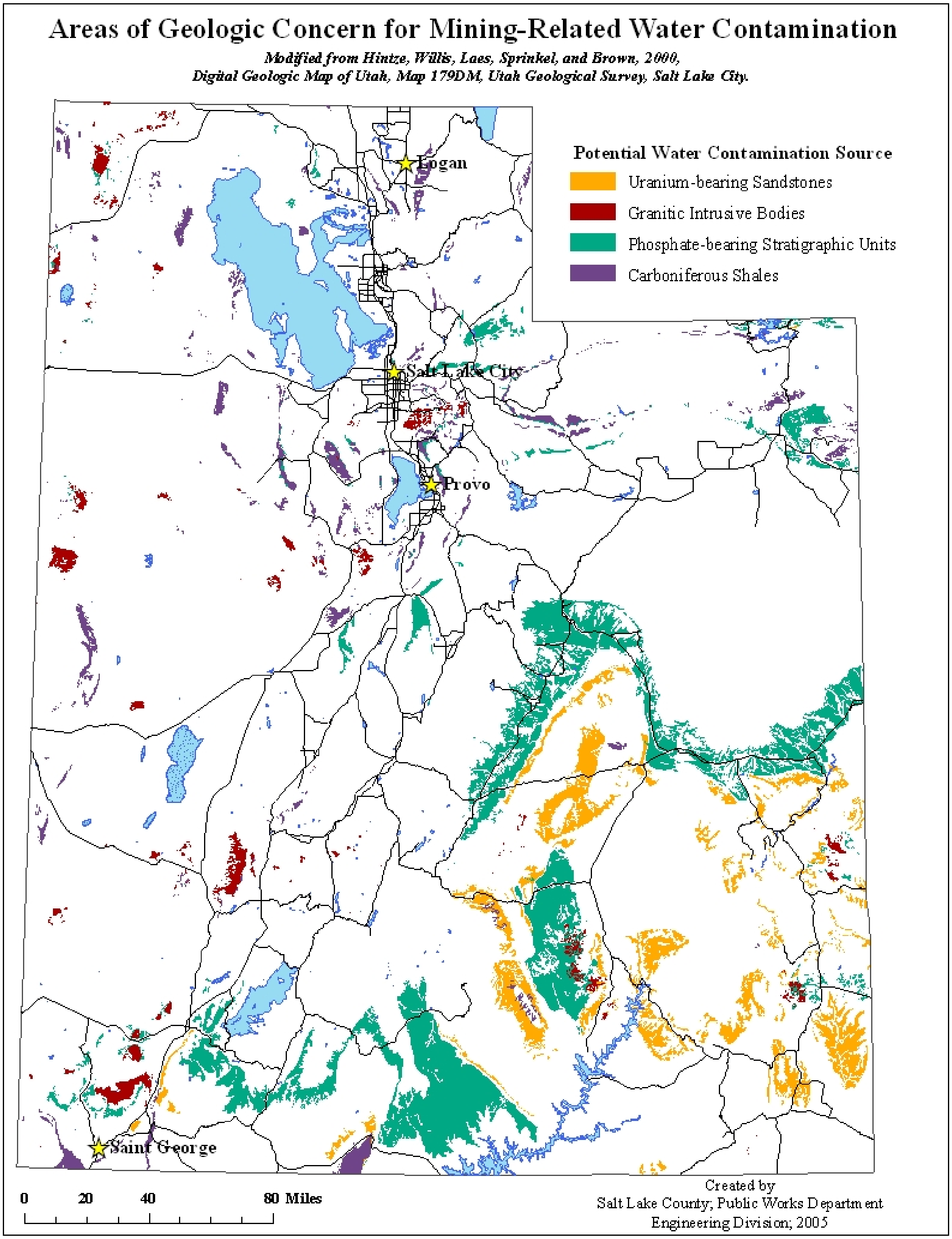


Figure 14. Average annual precipitation in Utah 1961-1900

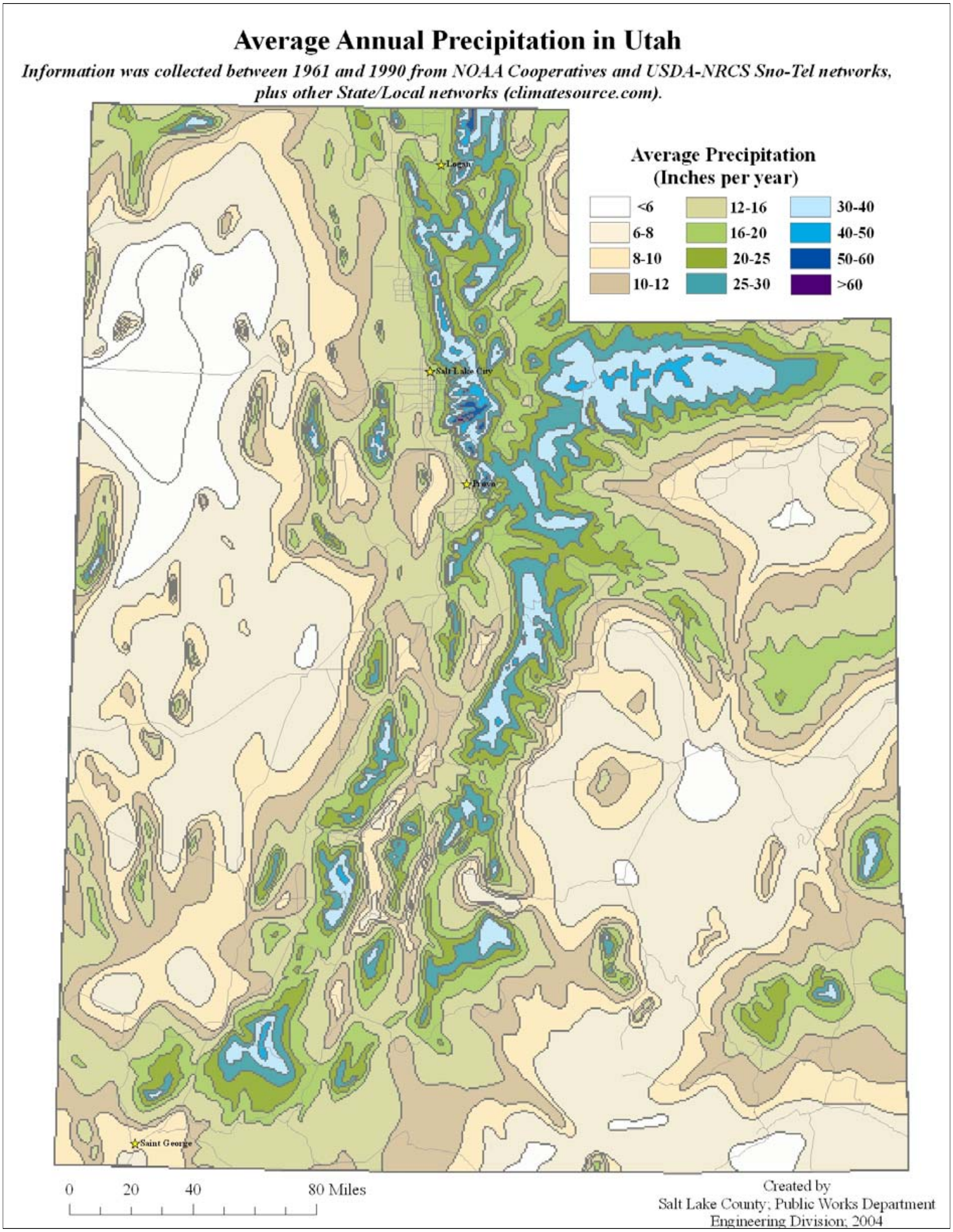


Figure 15. Major and minor waterbodies in Utah.

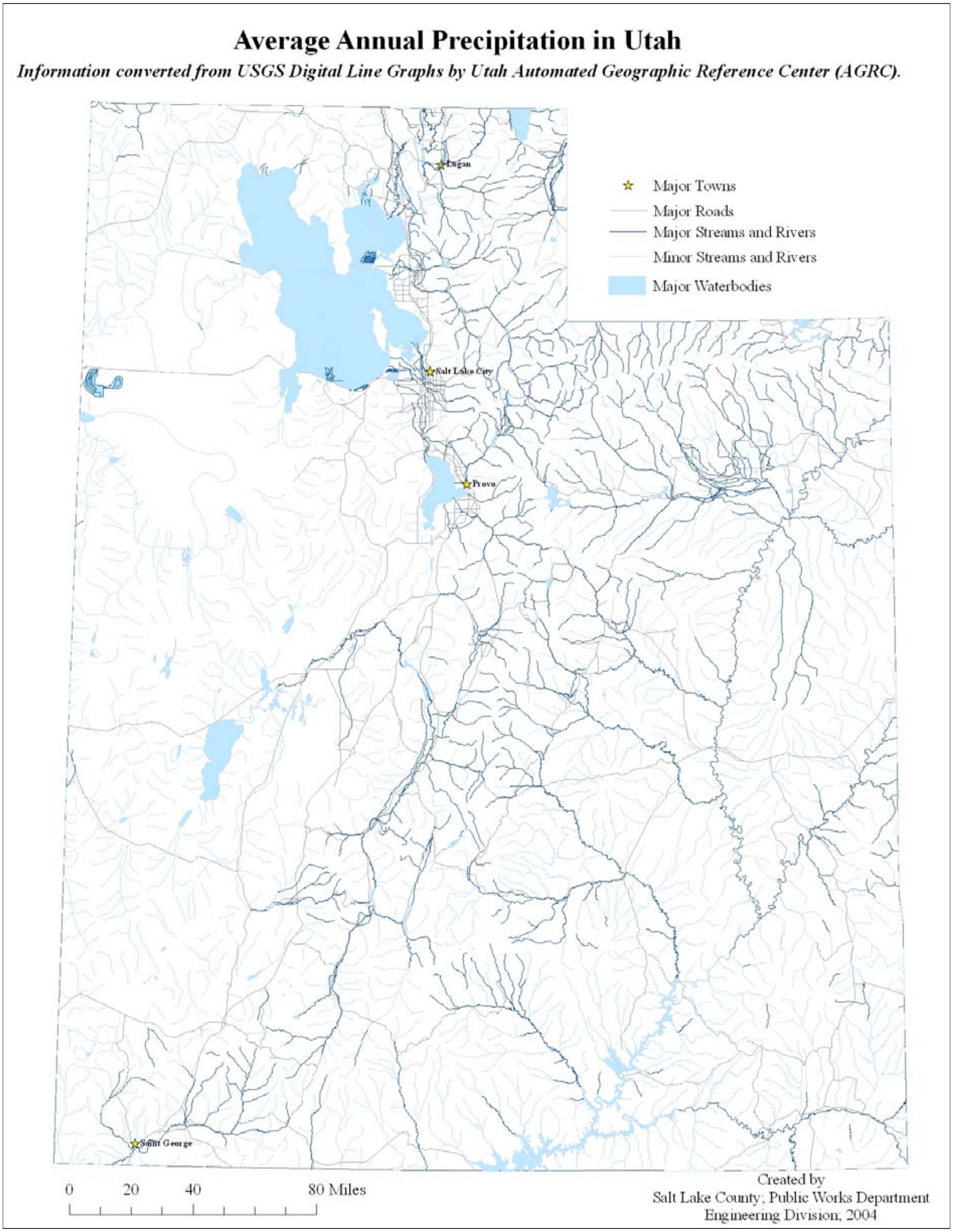


Figure 16. Stream assessment data for 2004.

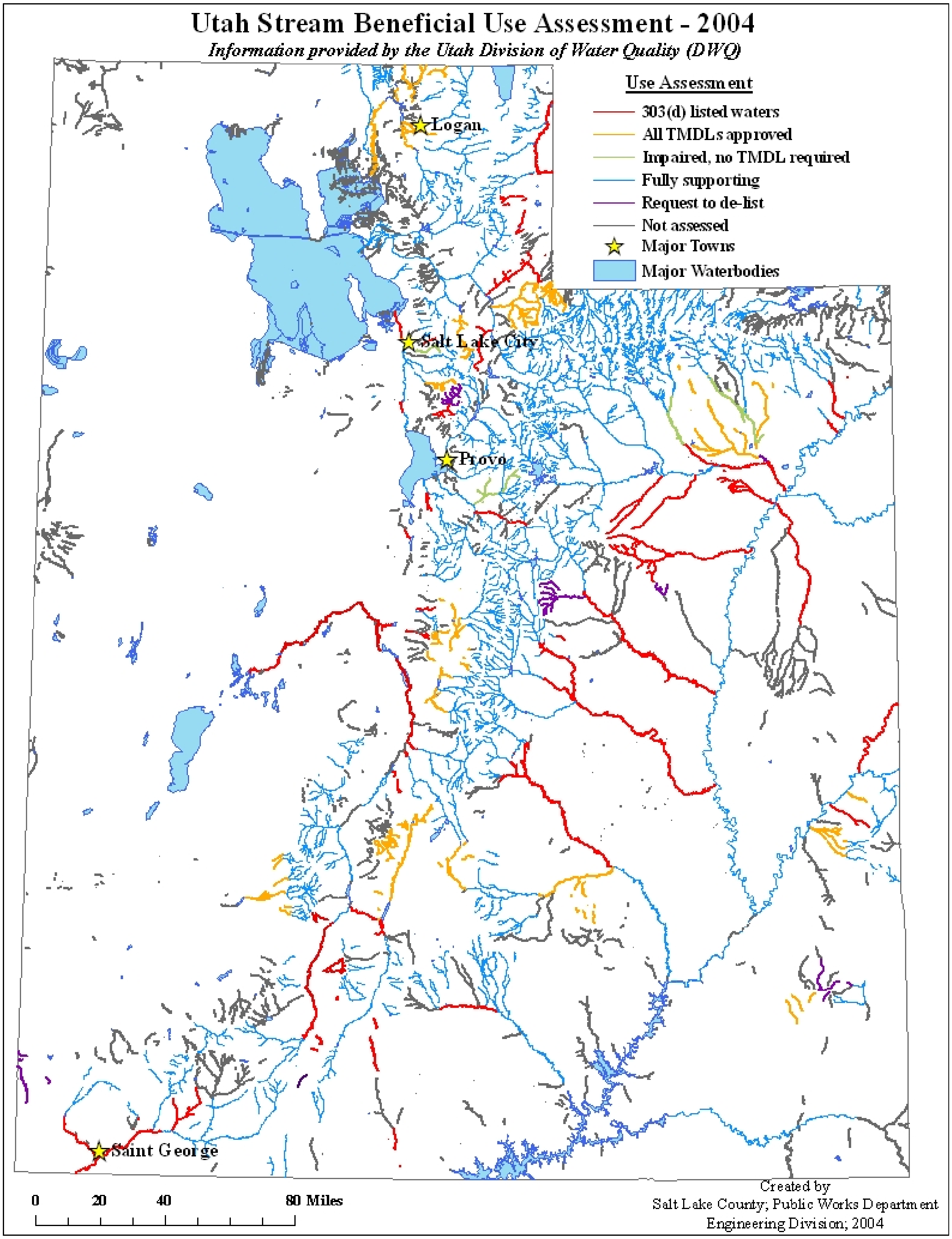


Figure 17. Lake Beneficial Use Assessment—2004.

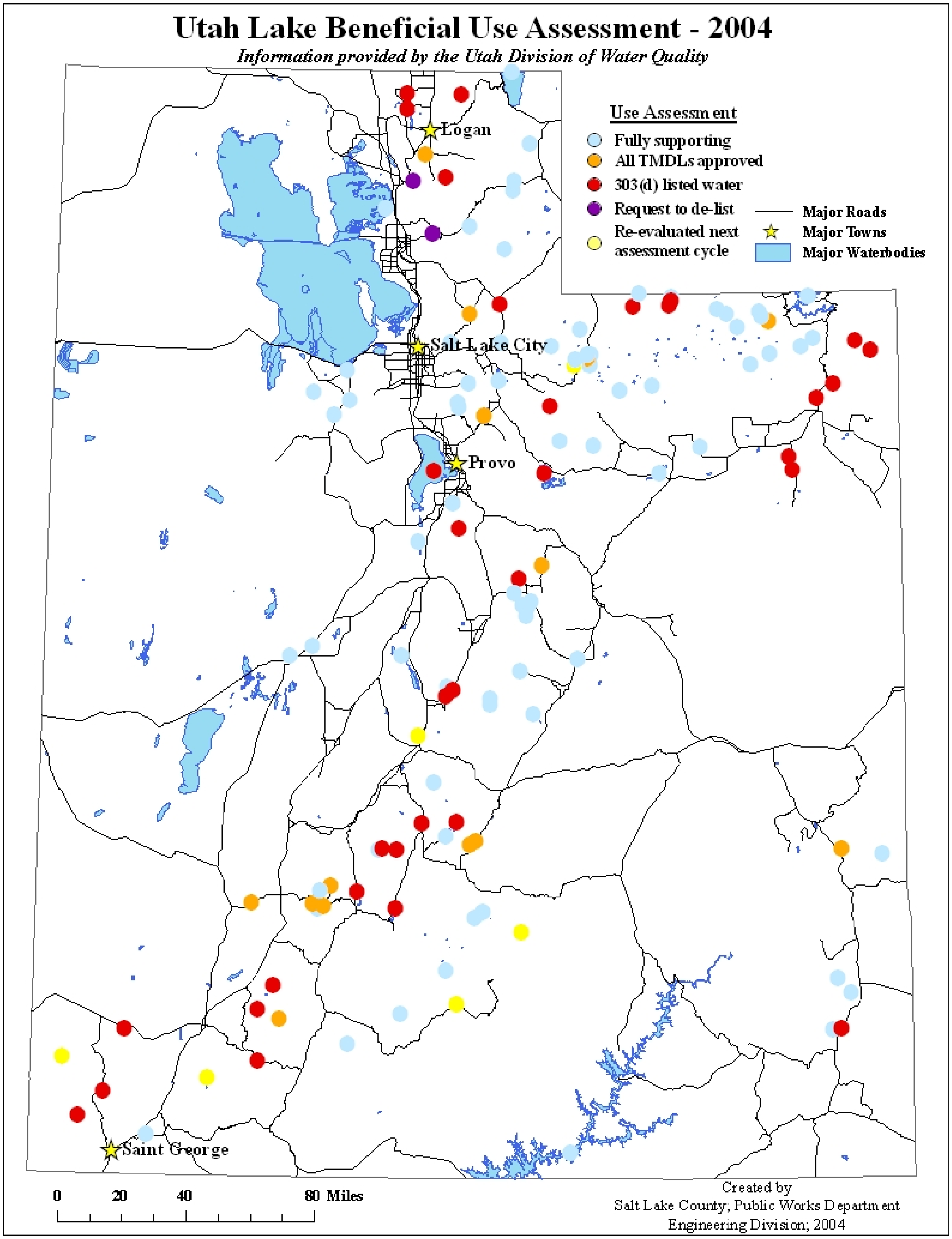


Figure 18. Distribution of elevation in Utah.

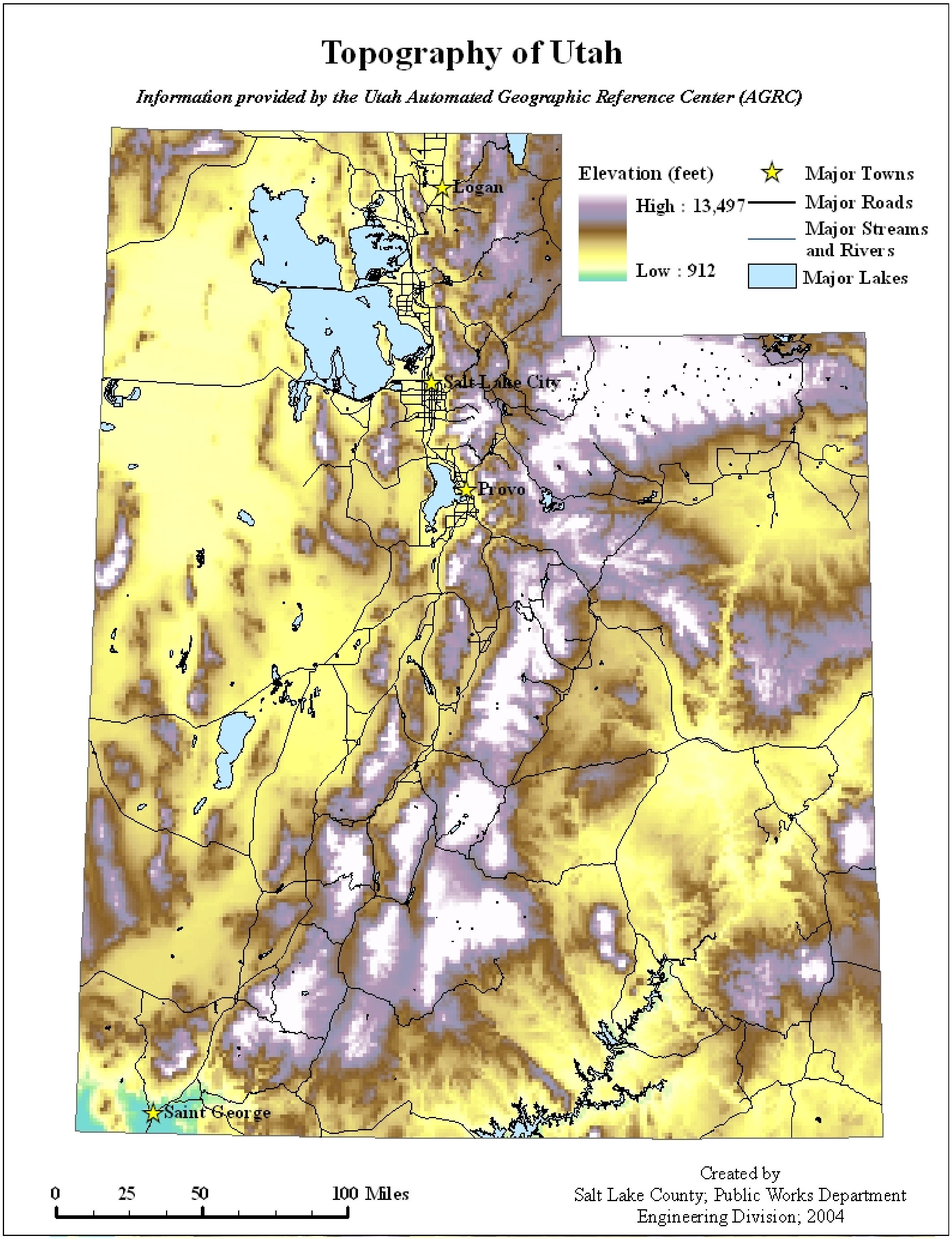


Figure 19. Land ownership in Utah.

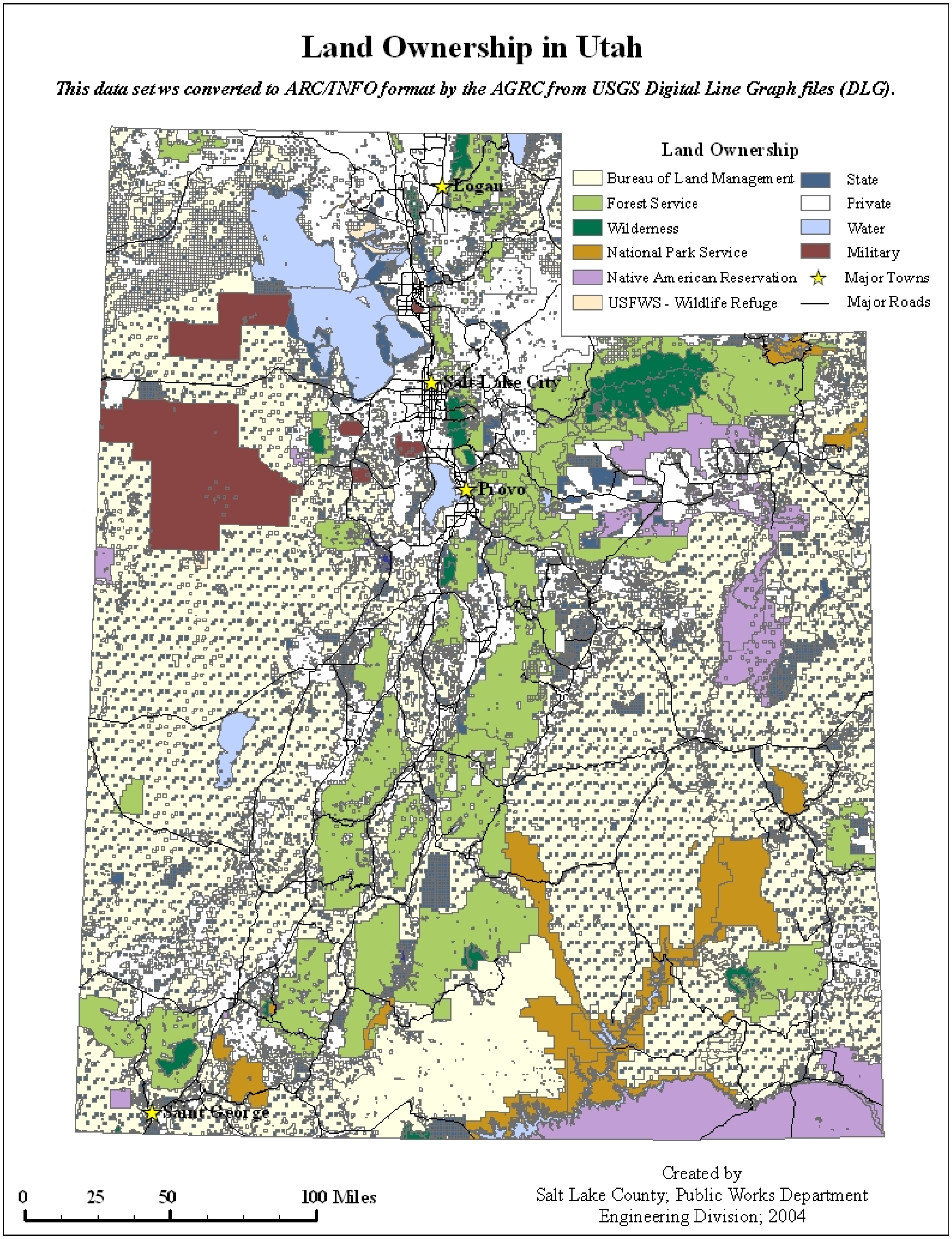
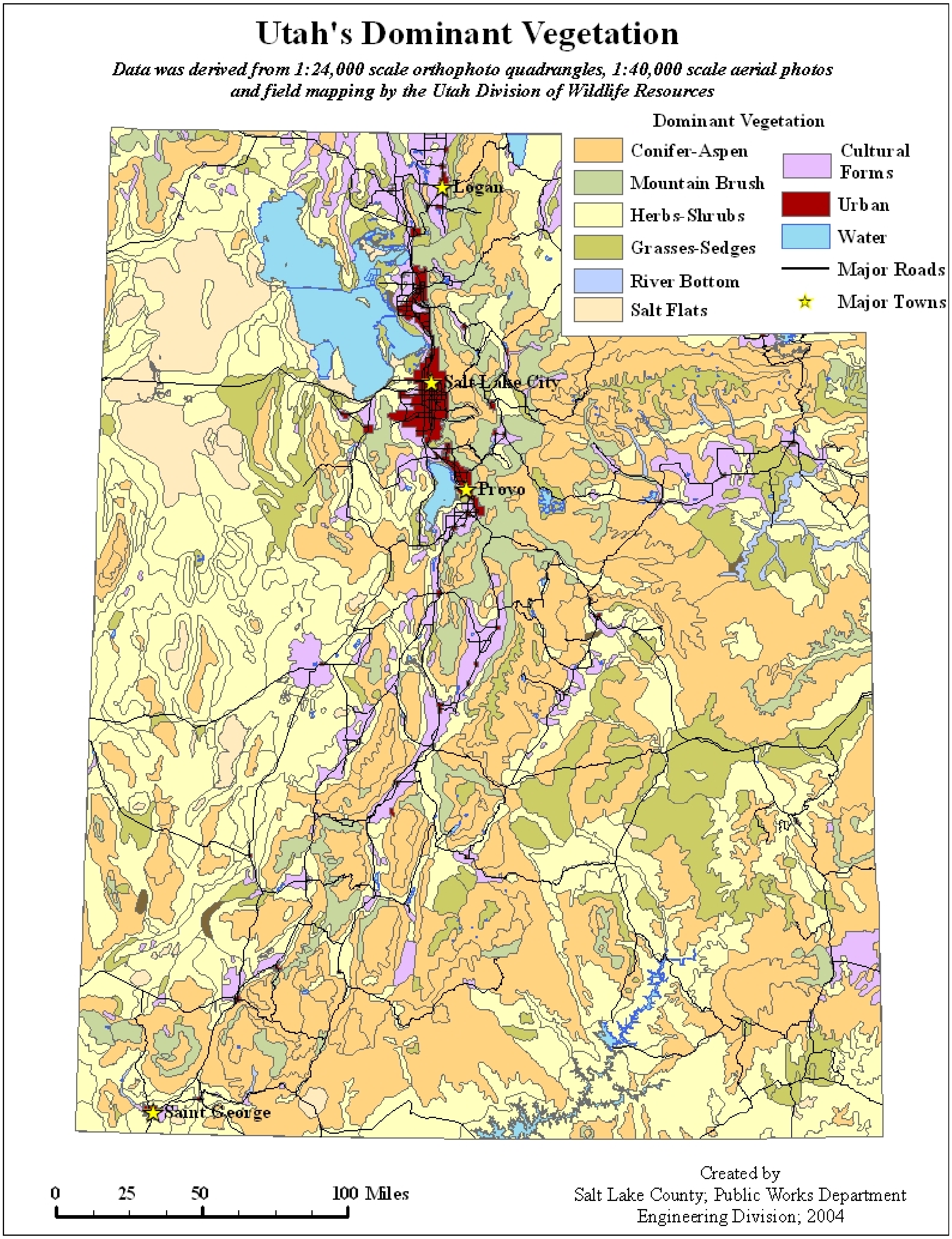


Figure 20. Dominant vegetation types in Utah.



III. UTAH'S APPROACH TO NONPOINT SOURCE CONTROL FOR ABANDONED MINE SITES

Utah's mining nonpoint source program is designed to address mining water quality impacts that are the result of mining activities that occurred previous to the passage of the Clean Water Act in 1972. The program takes an iterative approach, in conjunction with the State's Total Maximum Daily Load (TMDL) program, to the control of these sources. This approach begins with the identification of stream segments that are impaired due to abandoned mine related sources. The process uses a scientific approach to remediation based upon the targeting of sources of pollution through the collection of data, setting of goals for cleanup, determining clean up strategies, and use of appropriate regulatory and non-regulatory mechanisms to implement those strategies. It also provides follow-up monitoring to determine if the efforts are successful (Figure 23).

Figure 21. Pond near Goldminer's Daughter and Little Cottonwood Creek, Alta, UT.

Figure 22. Cell outlet of Alta fen pilot project.

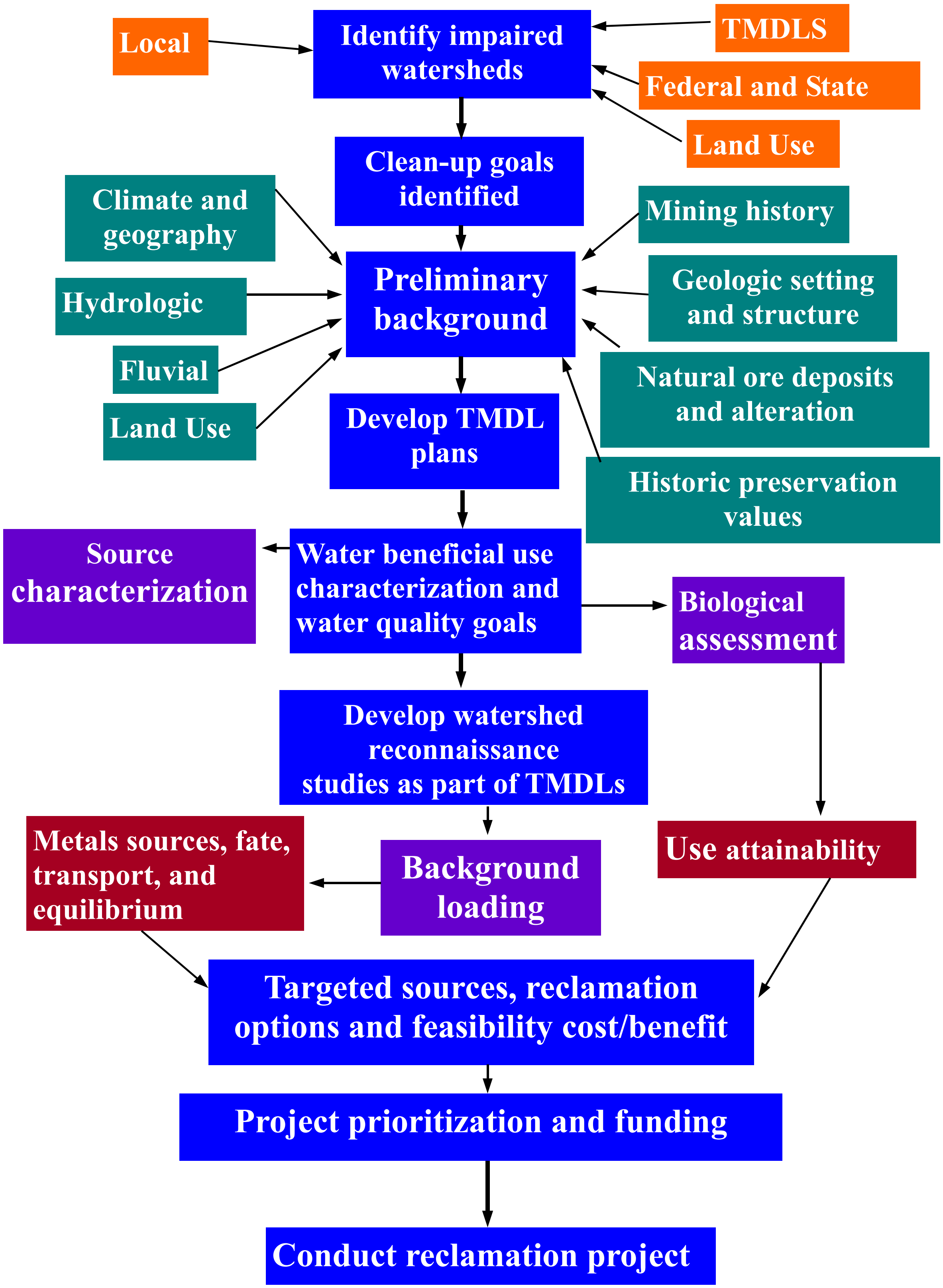
Identification of Mining Impacted Streams

In Utah, significant work has been done to address abandoned mine reclamation. However, minimal stream chemistry information was available for most of these actions. Therefore, in conjunction with the development of Total Maximum Daily Load (TMDL) Watershed Plans, it is critical to characterize the chemical, physical, and biological health of impacted segments in order to determine the full impacts of these activities and the potential for restoring, or improving beneficial uses.

A systematic program for scientific data collection, which characterizes pollution sources and stream health, is the process most states use. This information should be gathered prior to taking the next steps and ultimately prescribing actions for the abatement of pollution and preparation of specific project implementation plans. Metal source characterization also provides data for prioritization of mine sites for cleanup and reclamation. In addition to source characterization, reconnaissance watershed studies should include aquatic and biological assessment as well as background loading investigations as part of TMDL development.

The following is a general description of the source characterization process and sampling considerations, but does not necessarily describe the exact process the State will always follow.

Figure 23. Systematic approach to mine reclamation in Utah



It should be noted that conducting such an extensive investigation requires a large staff effort as well as funding mechanisms to pay for the staff, necessary equipment, and laboratory costs. To begin with, the State of Utah chooses a different approach—coordinating with other agencies and organizations in identifying known areas and known sources of pollution.

Figure 24. Organic carbon discharge, Alta Fen pilot project.

Preliminary Information Gathering

Watershed assessment begins with gathering a wide range of information about the watershed. Factors for consideration include:

- Mining history
- Geologic setting
- Structural setting, climate and geography
- Stream hydrology
- Land ownership
- Hydrologic impacts
- Current land use
- Historic sites
- Ore mineralogy
- Ore deposition
- Alteration mineralogy
- Mining methods
- Beneficial use of water

Stream and Mine Discharge Characterization

Surface

The most important characterization tool for streams and mine discharge is surface water sampling. Stream and mine discharge samples provide data to isolate the most important pollutant sources in a watershed. For some locations it may be possible to accomplish this characterization with a tracer-injection and synoptic-sampling analysis. Results can subsequently aid in the prioritization of sites and projects. In order for sample data to be meaningful, the data must be accurate and reproducible. Sampling plans and protocols help to assure the accuracy of data by creating standard procedures for data collection and management.

Each project requires both Sampling Analysis Plans (SAP) and Quality Assurance Project Plans (QAPP) (Appendix F).

Initial Field Reconnaissance

Some of the factors that may be considered in the initial field reconnaissance studies of streams and mine discharge include:

- Accurate locations of all draining adits and shafts
- Field measurements of pH, conductivity, and temperature
- Analysis of Total Suspended Solids
- X-Ray Fluorescence investigations
- Flow estimates
- Map flow pathways to streams
- Visual metals indications, precipitates and staining
- Seasonal flow and chemistry variations
- Tracer study locations and design of program
    - Fluorescent dye tracing
    - Ionic tracer methods
    - Injection and recovery sampling locations
    - Fate and transport modeling

Figure 25. Runoff from Blackbird Mine (a cobalt mine) on the Salmon-Challis NF, near Salmon, ID.

Mine/Groundwater Sources and Pathways

Groundwater Source and Pathway Studies

Groundwater source and pathway studies determine the contribution that mine discharge may have to local groundwater systems, and can delineate contaminant pathways.

Initial Field Reconnaissance

Some of the factors that may be considered in the initial field reconnaissance studies preceding mine groundwater sources and pathway sampling include:

- Structural geologic evaluations such as faults, fractures, and joint systems in addition to porosity and permeability estimates of rock units
- GPS locations of all springs and seeps
- Temperature surveys of adits and springs
- High-flow and low-flow measurements and comparisons to adit discharges
- Existing well data (upstream and downstream)
- Tracer injection studies

Mine Waste Rock Characterization

Mine Waste Sampling

The QAP and the SAP for the sampling of mine waste rock are similar to those for surface water sampling in that the goal is to assure accurate and reproducible results. The difference between surface water and mine waste samples is the availability and mobility of metals. Mine waste may contain high levels of heavy metals, however the waste may have a minimal impact on water quality if the metals are not leached from the waste. The chemistry of each waste pile is different and samples can help determine the impact that the site has on the watershed.

Initial Field Reconnaissance

Some of the factors that may be considered in the initial field reconnaissance studies of mine waste rock include:

- Accurate locations of waste deposits
- pH and reactivity of wastes
- Gangue minerals and buffering potential
- Volume estimates of individual deposits
- Visual indications of pollution such as vegetative stress and oxide staining
- Secondary metal oxide formation
- Seepage, contact with water and proximity to streams
- Background radioactive constituent readings
- Stability with respect to erosion and stream encroachment

Figure 26. Snowmelt near Little Cottonwood Creek, Alta, UT.

Setting Goals for Specific Nonpoint Source Mine Projects

Establishing goals for stream segments impacted by abandoned mining requires the collection of the data mentioned above and the consideration of existing water quality standards as well as stream classifications. An understanding of the potential productivity of the stream system and its aquatic ecology is also necessary to establish appropriate goals for clean up projects. Generally this means a Use Attainability Analysis (UAA) for stream segments to determine the appropriate beneficial uses, the levels of protection for sensitive aquatic species, and the ability of the watershed and site to produce and sustain that desired use. Some pertinent water quality standards for aquatic life, agricultural, and recreational use are provided in Appendix B. Since the establishment of goals may influence the actions taken in local communities, it is important that the process is conducted with the benefit of local involvement and participation.

Figure 27. Pacific Mill site, American Fork Canyon, UT. Leachate emanating from waste rock pile and entering river.

Figure 28. Pacific Mill site, American Fork Canyon, UT. Mine drainage.

Establishing Strategies

Once the goals for a clean up effort are established, the next step is to analyze how such goals may be attained. This process of strategizing often involves considering the sources of pollution, the range of possible controls, the effectiveness of those controls, and then comparing the results of various clean up strategies or scenarios against the goal for water quality improvement. This process may be fairly simple, if the numbers of sites considered are few; however, this process may be very time consuming and complex if the number or the characteristics of sites are large and highly varied.

Preparing reclamation strategies and alternatives requires a significant knowledge of the site to determine the potential effectiveness of various control scenarios. Additional specific site characterization work may be required to determine the most appropriate and cost effective means of control. Strategies may require computer modeling to determine if the composite of various scenarios will allow established goals to be attained. The results of these strategy efforts may be reflected as Total Maximum Daily Loads (TMDLs) targets for stream segments listed under Section 303(d) of the Clean Water Act.

IV. BEST MANAGEMENT PRACTICES

Introduction

Mining, by its nature, brings un-weathered rock materials from the interior of the earth to the surface. Mining and subsequent processing of ore break the rock into fine particles, vastly increasing the surface area available for chemical reactions with air and water. Underground mine workings act as wells, collecting ground water and providing a conduit for water to the surface. Waste rock historically was dumped immediately downhill of a mine, an act of expedience that put the wastes directly in the path of water discharged from the mine. If the mine water had not already become contaminated in the mine, it would become contaminated percolating through the dump. Clean surface runoff can similarly become contaminated by flowing over or through waste dumps.

Areas of Concern

Local geology, surface and groundwater hydrology, and mining technology (e.g. underground vs. open pit) all affect the degree to which water quality is diminished by abandoned mines. In Utah, several categories of water pollution are of particular concern. Acid rock drainage, heavy metals, radioactivity and sediment are some of these categories.

Acid rock drainage is a problem not only because of the effects of the acidity itself on aquatic life, but because metals in the rock are mobilized by acidic conditions. The dissolved metals, depending on concentration, can have acute or chronic toxicity on fish, wildlife, livestock, and humans.

Sediment eroded from mine sites increases water turbidity and deposits silt on fish spawning areas, as well as carrying chemical pollutants from the mine into headwater streams of use for municipal water supply.

Acid rock drainage, also known as acid mine drainage (both terms are frequently referred to by their acronyms, ARD and AMD) forms when surface water or shallow groundwater reacts with rock containing sulfide minerals such as pyrite and air to form sulfuric acid. The acid leaches heavy metals from mineralized rock and keeps the metals in solution. Typical metals mobilized by ARD are iron, aluminum, manganese, copper, arsenic, and zinc and to a lesser extent, lead, selenium, silver, and cadmium. These metals are then dispersed in the water draining from the mineralized areas. As ARD gradually neutralizes, the dissolved metals may cause elevated levels of Total Dissolved Solids (TDS), which may impact downstream aquatic and culinary uses. Iron commonly is one of the metals mobilized by ARD; it precipitates as an orange or yellow coating on rocks and vegetation in the stream channel. This staining, called "yellow boy," is a dramatic visible indicator that ARD is present in a watercourse. Acid drainage can adversely impact aquatic and human health when it contaminates surface water and groundwater.

Figure 29. Media placement over straw layer in Alta Fen Pilot Project.

Figure 30. Constructed repository in American Fork Canyon, UT, before placement of mine waste from Pacific Mill.

Sediment and colloidal material[4] resulting from mining and milling activities can contaminate streams, rivers, wetlands and other riparian areas. Sediment and colloid loads often contain high concentrations of heavy metals, radioactive constituents, or other dissolved solids that can destroy aquatic habitats as well as release metals and radioactive constituents to the water column. Sediment and colloids at high enough levels in the water can also affect suitability of the water for human uses such as agriculture and drinking water.

[4] Sediment and colloids are both solid particles suspended in the water column. Sediment particles are held in suspension by the water's motion and will eventually settle out when the water velocity drops. Colloids are so very fine that they are suspended in the water by Brownian motion and do not settle out by gravity. Although they do not settle out, colloids can accumulate in sediments when flow is "filtered" through alluvial deposits or when they are taken up by living organisms.

Purposes of Best Management Practices

Best management practices[5] (BMPs) are those techniques proven to effectively reduce environmental degradation. Some abandoned mine nonpoint source best management practices, especially those directed at controlling soil erosion and sediment loss, employ simple, "low-tech" ideas. Others require sophisticated engineering and specialized machinery. Some BMPs cost nothing; others can cost millions. Regardless of cost or complexity, BMPs set the bar for reclamation because they work. BMP manuals give reclamation planners a toolbox of techniques to draw from and guidelines for designing reclamation projects.

BMPs provide a standard of comparison for reclamation proposals. Project proposals funded by the Mining Nonpoint Source Management Program should make use of BMPs to achieve the following goals:

- Prevent adverse human health impacts.
- Improve habitat conditions for fish and wildlife.
- Prevent mine and mill waste sediments containing heavy metals or radioactive constituents from entering surface waters to achieve TMDL as applicable.
- Manage and control the process of acid water formation and heavy metal mobilization that may contaminate surface water and groundwater.
- Enhance the natural beauty and visual quality of a reclaimed area.

Remediation[6] of water quality problems originating at abandoned mines is an evolving, dynamic science. Ideally, the "best" in "best management practice" is a moving target. Today's cutting edge BMP may be tomorrow's standard operating procedure. Over time, some techniques will prove successful and become widely adopted; others may not live up to their initial promise and will be discarded as better techniques come available. BMPs for mining related nonpoint source pollution in Utah need to address both primary categories of problems: acid rock drainage and sediment. A wide range of technologies can be applied to the remediation of abandoned mined lands. Management of acid rock drainage entails practices that are more or less unique to mine reclamation. Sediment and erosion control at mine sites share techniques with BMPs for construction, forestry, and agricultural settings.

Figure 31. Mine waste rock from Pacific Mine, American Fork Canyon, UT.

[5] *A best management practice, often referred to simply as BMP, is a practice (or combination of practices) that is determined to be the most effective, practical, economical, and technologically sophisticated means to better manage mining wastes and prevent or reduce contamination of groundwater.*

[6] *"Remediation" has a specific meaning within the CERCLA (Superfund) context when applied to contaminated sites, including mines and mills. It is used here in its common, general sense of a treatment or process to reduce or eliminate a problem.*

Because BMPs change, it is not appropriate in this document to list a cookbook of BMP recipes for every conceivable abandoned mine problem. Also, because conditions vary so much from mine to mine, and because remediation requires site-specific design, it is beyond the scope of this document to present detailed design specifications. That sort of information is available elsewhere (see the references at the end of this section). Applicants for grants under the Mining Nonpoint Source Management Program should make an effort to reflect the current state of knowledge for nonpoint source remediation.

BMPs for Control of Acid Rock Drainage

BMPs to remediate acid drainage and dissolved metals generally take one of these approaches:

- *Divert* clean water away from reactive materials to prevent contamination.
- *Remove* reactive materials from contact with water.
- *Isolate* reactive materials from surface and/or subsurface water to prevent contamination.
- *Manipulate water chemistry* to favor desired conditions.
- *Treat* contaminated water to remove contaminants.

The first three approaches try to prevent contamination from happening; the others try to remove contamination after it has occurred. The preventive methods are based on this oversimplified reaction describing ARD formation: sulfide mineral + water + air = ARD. Bacteria catalyze the process. Remove any component from the mix and ARD does not form. The treatment methods work on a more sophisticated understanding of the suite of chemical reactions that cause ARD. Many remediation methods may work on more than one approach at the same time.

In general, Utah's Nonpoint Source Management Plan favors "passive" forms of treatment; however, when prevention of ARD by keeping reactive minerals separated from water is not feasible, methods that reduce or remove acidity and dissolved metals from the water are needed. These methods require a more nuanced understanding of ARD chemistry and require more sophisticated engineering and technology. ARD treatment technologies are classed as active or passive treatment. Active treatment requires ongoing inputs of energy, labor, materials, and money to operate and maintain a treatment facility or apparatus. Passive treatments are designed to be self-sustaining once started and to operate without external energy inputs and with only occasional maintenance. Since orphaned or abandoned mines are often remote and most organizations engaged in mine reclamation cannot commit the resources for long-term water treatment, active technologies are usually not desirable. Passive methods are generally preferred. No active treatment BMPs are discussed here.

Figure 32. Mine waste dredge and haul operations in Cement Creek Animas Basin, CO. (An example of BMPs for control of Acid Rock Drainage)

Diversion

Diversion methods keep clean water away from reactive materials such as mine dumps, mine waste, and ore bodies. At its simplest, diversion can be a small ditch upslope of a mine dump to route surface runoff around the dump. Good quality water flowing from a mine portal onto a dump can be diverted in a pipe or channel around the dump instead. Impermeable soil covers or "store release" soil caps can be used to prevent infiltration of precipitation into mine waste piles. A more complex diversion method is sealing underground rock fractures with grout to prevent groundwater from contacting sulfide mineral deposits.

Removal

Removal is a simple way to prevent ARD. Mine wastes were sometimes dumped directly into perennial or intermittent stream channels. Adit discharges sometimes flow directly onto dumps. Where mine wastes lie in the path of water, the wastes can be excavated and moved to a dry location. Multiple small waste piles can be moved and consolidated into a single pile to reduce the effective area exposed to rainfall and runoff. Wastes should be graded to promote runoff away from the waste rather than infiltration, and minimize erosion. Once physically removed from contact with water, the wastes can be further protected with flow barriers to isolate them from water as discussed below.

Isolation

Reactive mine wastes can be isolated from water by burial or capping. This puts a layer of uncontaminated inert material over the reactive material. The cover layer limits the contact of the wastes with water and air, reducing acid generation. The cover shields the wastes from erosion and can act as a growth medium for vegetation, which provides additional erosion control benefits and aesthetic improvement. Capping or burial can be done with the wastes *in situ* or removed to a disposal site. A cap may be as simple as a layer of local soil obtained on-site, or it may be a complex, multilayered barrier of engineered materials, such as compacted clay, synthetic geotextiles, or geomembranes designed to reduce infiltration and subsequent leaching. The specific design of the cover layer depends on the characteristics of the site and the acid generating potential of the wastes. A surface cap is often sufficient, but some situations may require a liner under the wastes to completely encapsulate the material.

Figure 33. Griffon Mine and Mill site, near Ely, Nevada, before reclamation.

Manipulation of Water Chemistry

Several passive treatment methods work by introducing alkalinity into the system to raise the pH of the water. Dissolved metals are less soluble at higher pH's and precipitate out of solution. Some passive treatment methods take advantage of biological processes to alter pH and metal solubility.

Anoxic Limestone Drains

Anoxic limestone drains are constructed so that ARD water is directed through coarse limestone in a sealed, saturated system, such as a plugged adit or closed trench. Oxygen-free conditions are required so that metal hydroxide precipitates do not form in the drain and coat the limestone, stopping the neutralization action and clogging pore space. Water leaving the anoxic drain is then aerated in a settling pond to allow the metals to precipitate.

BMPs for Control of Acid Rock Drainage—Continued

Oxic Limestone Drains

Oxic limestone drains are an alternative to anoxic drains where dissolved metal concentrations are low. ARD is allowed to flow over limestone in an open trench. It has the advantage that the "consumption" of limestone can be monitored and the trench refilled as necessary. Success in the western United States has been limited due to a higher iron and aluminum content in ARD, which precipitates and "armors" the limestone surfaces. These systems are often compromised by high precipitation events and spring snowmelt runoff.

Aqueous Lime Injection

Aqueous lime injection is a passive method to introduce neutralizing agents into mine drainage. Clean water is passed through a pond containing an alkaline neutralizing agent such as kiln dust or fly ash. The high pH effluent is mixed with the mine drainage before it enters a settling pond. The pH of the mine drainage is subsequently lowered. This system depends on having an economical source of neutralizing agent available.

Treatment of water to reduce/remove contaminants

Inhibition of Sulfur Oxidizing Bacteria

Some types of bacteria, notably *Thiobacillus ferroxidans*, mediate certain steps of the series of chemical reactions that convert sulfide minerals into sulfuric acid (ARD). By controlling the bacteria, the production of ARD can be controlled. One method to reduce acid formation in abandoned coal refuse piles uses a surfactant detergent in time-release pellets to inhibit bacterial growth.

Sulfate Reducing Wetlands

Just as *Thiobacillus* bacteria play a role in ARD generation and can be exploited for its control, other types of bacteria play a role in ARD neutralization and can be put to work treating ARD. These bacteria use the oxygen in the sulfates found in ARD for their respiration and in the process reduce the sulfates to sulfides, which react with dissolved metals in the water to form insoluble precipitates. This bacterial action both raises the pH of the water and removes metals. A common method of cultivating bacteria for ARD treatment is the sulfate reducing wetland. These are shallow artificial basins with a gravel and perforated pipe subdrain collection system. On top of this is placed a thick layer of organic matter (such as manure, compost, straw, or sawdust) to act as a growth substrate and source of carbon for the bacteria. ARD in open pit mine impoundments has been successfully treated by simply dumping large amounts of molasses (carbon source for bacteria) and methanol (to force the bacterial respiration to be aerobic) directly into the water.

Oxidation Wetlands

Unlike sulfate reducing wetlands, oxidation wetlands reduce ARD through oxidation. These wetlands look and function like typical natural wetlands. Familiar wetland plants, like cattails, sedges, rushes, and algae aerate the water and cause metals to precipitate. The metals adsorb to the plants and accumulate in the organic sediments.

Institutional Controls

Institutional controls use physical barriers and/ or land use restrictions to reduce the potential for human exposure to harmful material. Fencing, signage, and road closures can discourage visitation to mine sites. Removal of structures can make a site less appealing to visit. While institutional controls can reduce human exposure to risk, they do nothing to address the source of the contamination or prevent its spread. Furthermore, they are easily circumvented and are not totally effective at preventing exposure. However, institutional controls can be useful tools for short-term risk management until reclamation can be completed.

Figure 34. Bully Boy mine in Ohio District of Bullion Canyon, Tushar Mountains, Piute County, UT.

BMPs for Control of Radiological Problems

Uranium mines are plentiful in the Colorado Plateau of southeastern Utah and in other localities, such as near Marysvale. Uranium may occur in small quantities in association with other minerals statewide. Radiation adds another dimension to the health and environmental hazards of abandoned mines and makes uranium a special case. However, some of the same BMPs for controlling ARD and sediment are applicable since control of exposure still hinges on isolation, stabilization, and immobilization. As a metal, uranium is subject to mobilization in acidic conditions and therefore is also subject to ARD control techniques. Erosion control practices to stabilize mine waste dumps prevent uranium-bearing particles from migrating into the environment. Uranium mine reclamation projects may have radiation-specific design features (such as measures to address radon gas emissions and worker safety protocols) but will also use standard nonpoint source control BMPs.

BMPs for Control of Sediment and Erosion

BMPs for control of sediment and erosion generally take one of three approaches:

- *Manage runoff* to reduce its quantity and velocity.
- *Stabilize* fine soil or mine waste particles in place.
- *Trap* mobilized particles before they leave the site.

These processes are interrelated. Most erosion control techniques work on more than one erosion mechanism at the same time. For instance, plant leaves reduce the force of raindrop impact while the roots bind soil particles together. Soil surface roughness traps windblown organic debris (e.g. leaves, seeds) and moisture in the pockets, which aids the establishment of vegetation.

Construction activities to reclaim mine sites or to implement ARD remediation BMPs themselves create soil disturbance that can cause erosion. Excavation, regrading, and burial of mine dumps and mill mine waste turn an abandoned mine site into an active construction zone with its own set of erosion risks. An area beyond the original footprint of the mine site will be disturbed for access roads, borrow sites, and disposal sites. Erosion initiated by construction activities packs a double wallop: it depletes soils of nutrients and structure at the disturbance site and dumps deposits of silt at a downstream location. Any remediation project design needs to incorporate erosion control BMPs for construction disturbance as well as for erosion present at the mine.

Figure 35. Sawtooth Mill near Ketchum Idaho.

Figure 36. Mine waste rock dumps at Blackbird Mine, Salmon, Idaho.

Reducing the quantity and velocity of surface water runoff reduces the ability of runoff to displace soil particles and encourages infiltration. Reducing the gradient of slopes reduces runoff velocity. Surface roughness keeps water in one place and encourages infiltration. The scale of roughness can range from a few inches (tracking with cleats of crawler-type equipment) to several feet (terracing, dozer gouges). Roughness can be accomplished using standard earthwork equipment (dozers, trackhoes, or hand tools in small areas) although there are also specialized pocking and imprinting implements on the market. Ripping or subsoiling compacted soils allows water to infiltrate and helps root penetration. Mulches attenuate raindrop impact and absorb moisture, releasing it gradually. Mulches include straw (must be certified weed-free), plant wastes (e.g. leaves, wood chips, pine needles) and a variety of commercial products (e.g. excelsior or coconut fiber blankets and wood fibers applied by hydroseeding equipment).

Figure 37. Mine waste rock from Pacific Mine, American Fork Canyon, UT.

Although there are chemical soil binders available for short-term soil stabilization, the best way to keep soil in place is to establish vegetation. Vegetation provides a permanent, self-maintaining, soil cover that binds soil particles in a network of roots.

There are a number of techniques and products available to trap eroded soil and keep it from leaving a site and entering waterways. Straw bale check dams and fabric silt fences are among the most familiar. Very large disturbed areas may need sediment ponds. Proper installation and maintenance of sediment trap structures are critical, since failure can result in severe erosion. Sediment traps should be seen only as temporary measures to bridge the time until vegetation can be established to provide long-term erosion control.

Watershed remediation projects that re-align stream channels or restore streams that have been channelized or filled by mining operations can have significant implications for erosion since they result in disturbance within an active stream channel. In the past decade or two there has been increasing awareness and understanding of the geomorphological principles at work in determining the size, shape, and alignment of natural stream channels. Stream channel design is moving away from a traditional civil engineering approach (i.e. channel as a simple conduit for a design flow) towards more holistic and integrative approaches that incorporate biological bank stabilization techniques, geomorphic structural controls, etc. BMPs for work in stream channels should recognize this emerging school of thought, as stream channel restoration methods are being updated. BMPs for stream channel construction need to address material selection, season of operation, temporary diversions, habitat creation, equipment guidelines, and the experience and qualifications of contractors and overseers.

Summary of Sediment and Erosion Control Techniques

- Excavation/burial
- Reduce runoff
- Reduce slope
- Terracing
- Mulching
- Re-vegetation
- Check dams
- Sediment traps
- Stream channel restoration

Figure 38. Recreational ATV riding occurring on waste rock pile of Dutchman Mine and Mill site in American Fork Canyon, Utah County,

BMP Planning and Design

The previous discussion of BMPs has given a general overview of the range of techniques available for remediation of abandoned mine-related water problems. It has not addressed detailed design considerations or construction specifications. Proper application of BMP concepts requires analysis and understanding of the site characterization data outlined previously in Part III. It also requires a thorough understanding of the limitations of the BMPs. Not every BMP is appropriate for every situation.

The best source of assistance for planning and implementing any BMP will be in the locality where the BMPs are used. Local stakeholder groups and representatives from various natural resource management agencies, whether federal, state or local can assist in developing site-specific recommendations. These recommendations or designs account for the local climate, soils and hydrology of the area, as well as any social or cultural conditions.

Figure 39. Griffon Mine and Mill site, near Ely, Nevada, after reclamation.

Most of the BMPs described here need to be specifically tailored to a particular site. Considerations such as the dimensions and alignment of diversion ditches, the thickness and composition of caps to isolate mine wastes, the sizing and design of wetlands, and the selection of plant species to include in a seed mix all depend on the site-specific conditions. Guidelines for these design determinations can be found in the references listed below.

BMP References

Two publications produced by agencies actively involved in mine reclamation provide an excellent overview and summary of BMPs in this field. They are:

The Practical Guide to Reclamation in Utah. 2000. Utah Department of Natural Resources, Division of Oil, Gas & Mining. This 163-page publication is only available electronically. It is available online and can be downloaded as a pdf-format file (7.6 Mb) at: ftp://ogm.utah.gov/PUB/MINES/Coal_Related/RecMan/Reclamation_Manual.pdf

Best Practices in Abandoned Mine Land Reclamation: The Remediation of Past Mining Practices. 2002. Colorado Department of Natural Resources, Division of Minerals and Geology. This 42-page book is available in print or online and can be downloaded as a pdf-format file (1.0 Mb) at: www.mining.state.co.us/bmp.pdf

Mines and ski areas often occur in similar areas with comparable challenges for reclamation (high elevation, poor soils, short growing seasons, steep slopes). The following publication, although oriented towards ski areas, has many BMPs directly applicable to abandoned mine situations, particularly with regards to construction erosion controls and revegetation.

Ski Area BMPs (Best Management Practices): Guidelines for Planning, Erosion Control, and Reclamation. 2001. USDA Forest Service, Wasatch-Cache National Forest. This 35 page book is available online and can be downloaded as a pdf-format file (42 kb) at: http://www.fs.fed.us/r4/publications/pubs/screen_SkiBMPs.pdf

Sources of Current BMP Research Information

Several organizations of professionals and groups involved in mine reclamation and water resources hold conferences to present the latest developments in their fields. Papers cover both theoretical developments and on-the-ground applications. Proceedings may be difficult for the general public to find, as distribution is often limited to conference participants and a few academic libraries, but they are the best place to find the newest science. It may take years for developments in this field to make their way to wider interest publications. Articles may be obtained by contacting the sponsoring organization or using online search engines.

National Association of Abandoned Mine Land Programs (NAAMLP)
Organization of 26 state and tribal government agencies that conduct abandoned mine reclamation under the authority of the Surface Mining Control and Reclamation Act of 1977 (SMCRA). Sponsors an annual conference. No permanent mailing address (association administration rotates annually among member organizations).
E-mail: naamlp@onenet.net
www.onenet.net/~naamlp/

High Altitude Revegetation Committee
Department of Soil and Crop Sciences
Colorado State University
Fort Collins, CO 80523
(970) 484-4999
www.highaltitudereveg.com
Sponsors an annual symposium and summer field tour. The focus is on revegetation of disturbed lands in high altitude environments (short growing seasons, harsh conditions, poor soils, steep slopes).

American Water Resources Association
4 West Federal Street
P.O. Box 1626
Middleburg, VA 20118-1626
(540) 687-8390
(540) 687-8395 fax
E-mail: info@awra.org
www.awra.org/index.html
www.awra.org/proceedings/proceedings.html

American Society for Mining and Reclamation (ASMR)
3134 Montavesta Road
Lexington, KY 40502
(859) 335-6529
(859) 335-6529 fax
E-mail: asmr@insightbb.com
http://ces.ca.uky.edu/asmr/Index.htm
Sponsors an annual conference on mined land reclamation and produces proceedings and other publications. Known as the American Society for Surface Mining and Reclamation (ASSMR) prior to 2001.
http://ces.ca.uky.edu/asmr/Annual%20Conferences.htm

Reclamation Research Unit
Montana State University - Bozeman
Department of Land Resources and Environmental Sciences
College of Agriculture
106 Linfield Hall, Bozeman, MT 59717
(406) 994-4821
(406) 994-4876 fax
www.montana.edu/reclamation/index.html
The Reclamation Research Unit conducts research into remediation of drastically disturbed lands (particularly coal surface mining, but also other mining) and sponsors an annual symposium on reclamation. Symposium proceedings and other technical publications are available (see www.montana.edu/reclamation/publications.htm)

International Conference on Acid Rock Drainage (ICARD)
ICARD is a leading venue for the presentation of research on ARD. It is held every three years. It is sponsored by different organizations each time and has no permanent "home" address, either physically or on the Internet. Additional information can be found through online search engines or at the ICARD page on the INAP website: http://www.inap.com.au/Icard.htm

Sources of Current BMP Research Information—Continued

Serials/Journals

Journal of the American Water Resources Association
American Water Resources Association
4 West Federal Street
P.O. Box 1626
Middleburg, VA 20118-1626
(540) 687-8390
www.awra.org/jawra/index.html
Bimonthly peer-reviewed journal of original articles on all water resources-related subjects. Known as *Water Resources Bulletin* prior to 1997.

Land and Water: The Magazine of Natural Resource Management and Restoration
P.O. Box 1197
Fort Dodge, IA 50501
(515) 576-3191
www.landandwater.com
Bimonthly magazine for contractors, engineers, architects, and government officials working in natural resources fields, with an emphasis on soil and water conservation practices.

Figure 40. Millsite during reclamation in American Fork Canyon, Utah county, UT.

Other Sources of Information

Acid Rock Drainage at Enviromine.
Website created by Chris Mills and Andy Robertson in May, 1997. This website provides an excellent technical overview of acid rock drainage accessible to a general audience. The site explains ARD chemistry, predictive models, treatment, and has an extensive list of references.
http://technology.infomine.com/enviromine/ard/home.htm

Soil and Water Conservation Practices Handbook. 1988. U.S.D.A. Forest Service Regions 1 and 4, Forest Service Manual 2509.22.
This U.S. Forest Service handbook addressing conservation practices is currently being revised and updated. Chapter 10 (Soil And Water Conservation Practices Documentation) of this handbook outlines a large number of soil conservation and erosion control practices that are applicable to mine reclamation. This document is available online and can be downloaded as a txt-format text file at:
http://www.fs.fed.us/cgi-bin/Directives/get_dirs/fsh?2509.22!r4

Many commercial vendors of products used in reclamation (e.g. geotextiles, geomembranes, gabions, erosion control products) produce catalogs and other marketing materials with useful engineering and design information, including product specifications, design drawings, and manuals. These materials can be helpful in reclamation planning and design, though users should keep in mind that they represent a commercial point of view and may not be totally objective.

Interim Report IV, Alta Wetland Fen Pilot Project 1999 Monitoring Season. 2000. Salt Lake County Department of Public Works, Engineering Division, Water Resources Planning and Restoration.

This report summarizes water quality and soil data taken in 1999 for the Alta fen pilot project.

V. PRIORITIES AND GEOGRAPHIC PERSPECTIVE

There are four priorities for Utah's abandoned mine nonpoint source program. These priorities are often combined in individual actions and projects and include:

1. To abate known water quality impairments resulting from nonpoint source pollution.
2. To prevent significant future threats to water quality from abandoned mine sites.
3. To develop and implement new and existing technologies for water quality restoration.
4. To provide information and education to key decision-makers and landowners about the importance of nonpoint source initiatives.

These four priorities are incorporated in a geographic context to target the most critical needs for specific watersheds. By ranking and combining statewide GIS information (such as precipitation, elevation, location of impaired stream data etc.), a model will be created to identify and prioritize abandoned mine nonpoint source pollution sites for the state of Utah.

<u>Targeting Tools</u>

State water quality standards are the underlying framework for water quality management in Utah. Targeting tools that must be considered in the mining nonpoint source management program are the 2004 303(d) List, subsequent 303 (d) lists, and other Division of Water Quality policy or guidance documents. In developing the management program, these documents have been used to determine priorities for implementing nonpoint source activities for abandoned mining. The impaired segments listed in Utah's current 303(d) list stand as the official priorities for the program. All of these documents and their future updated submittals are incorporated as portions of this management program.

Figure 41. Historic Ball Mill Animas Basin, CO.

<u>State Water Quality-Limited Waters</u>

State water quality standards are the yardstick used by the Division of Water Quality to assess the status of an assessment unit. The state compares recent information regarding the physical, chemical and biological condition of waterbodies with current water quality standards. Where technology-based effluent limits in discharge permits alone are not stringent enough to assure that water quality standards are met, these stream segments are designated water quality-limited and added to the 303(d) list. This list of impaired water of the state is updated every two years.

The 303(d) list includes the identification of the specific pollutant (e.g. metal or sediment) that targets the specific water quality problem for a given segment. Total maximum daily loads (TMDL) are required for all contaminants on all stream segments in the 303(d) list. As defined by the Environmental Protection Agency, a "TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources." The TMDL process must quantify the pollutant sources and allocate allowable loads to the contributing sources for all water quality-limited stream .

Evaluation of nonpoint sources is an essential component of the TMDL process. Stream segments on the 303(d) list will be targeted for nonpoint source controls. Mining-related nonpoint sources have a significant impact on the water quality of selected streams in Utah and will be given a high priority in this process. For metal loading, tracer-injection studies have recently provided valuable information on the location and quantity of nonpoint sources in selected streams in the state, and the broader Rocky Mountain Region.

Source Water Protection Program

Like many western states, Utah is a headwater state where the majority of our water supply comes from snow and rainfall within the State. Utah's surface water supplies originate in the high mountainous regions of central and northeastern Utah. Figure 42 shows the major watersheds in Utah and may be used to identify nonpoint source pollution impacts by watershed. Notably, several watersheds in Utah are impacted by abandoned mines and can be addressed in the assessment and implementations portion of individual Source Water Protection plans prepared by water utilities.

Public Involvement/Watershed Approach

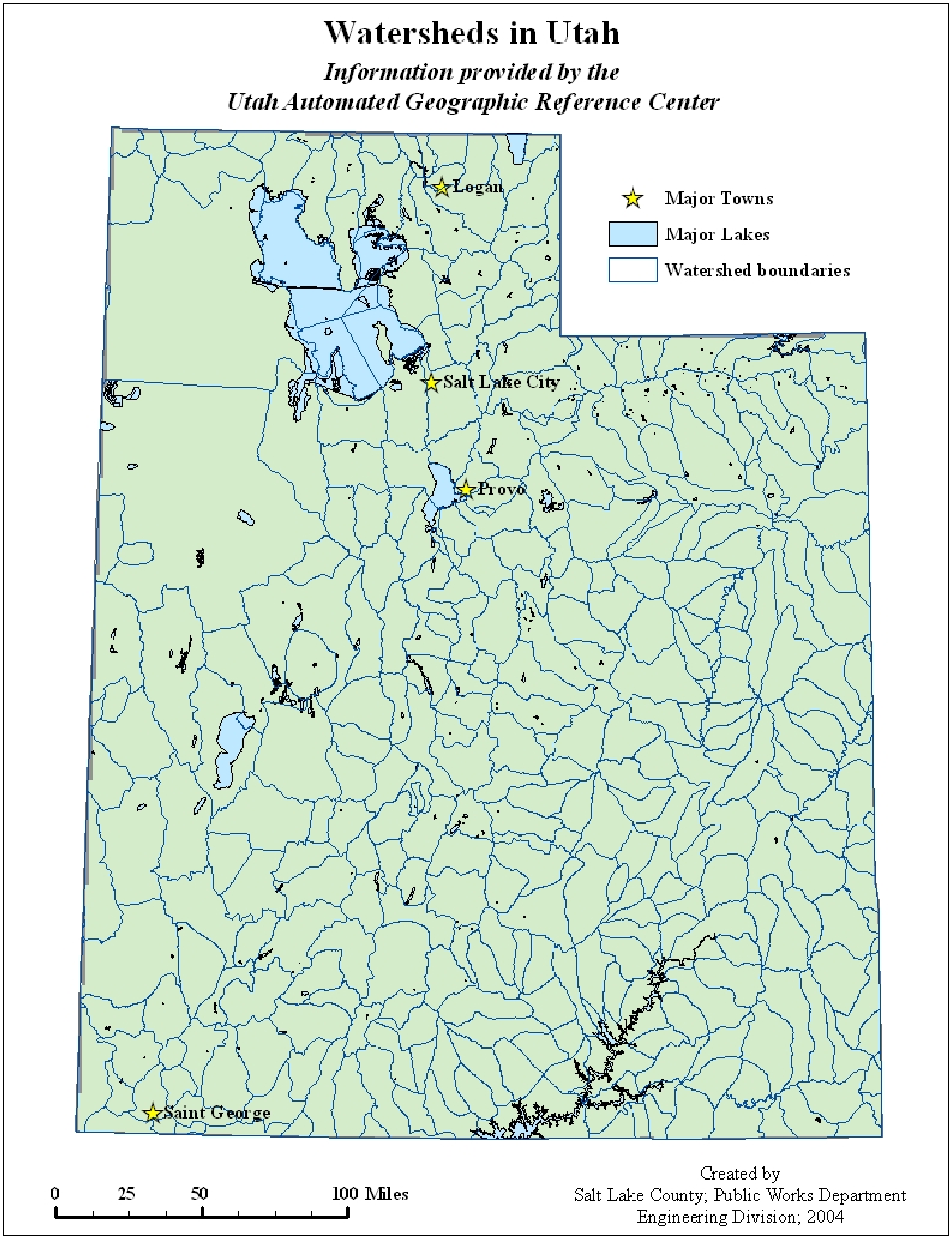
The trend in water quality management is toward a watershed-based approach, which is reflected in the assessment and implementation portion of the Source Water Protection Program. The watershed-based approach has led to a number of local and regional initiatives with diverse organizational models and functional roles. Notably, the listing of impaired waterbodies on the State's 303(d) leads to the development of Total Maximum Daily Load (TMDL) requirements. There are currently some twenty-five active local watershed committees throughout the State (See Appendix H).

The trend in water quality management is toward a watershed-based approach. This approach begins with comprehensive water quality monitoring throughout the drainage basis in an effort to identify both point and nonpoint sources of pollution. The severity of the pollutant contributions often leads to determinations that the beneficial uses of the stream or lake cannot be met unless pollutant loads are significantly reduced. This process is often referred to as the TMDL (Total Maximum Daily Load) evaluation, which ultimately leads to implementation of the most effective management practices to solve the problem.

The community plays a major role in this process, and may even inherit requirements for funding the implementation of management practices or pollutant reduction programs. Public involvement of both community interests and regulatory/financial stakeholders is essential to implementation of pollution control practices, with watershed committees often providing the vehicle for public participation. This watershed-based approach has led to many local and regional initiatives, such as watershed permitting, pollutant trading, annual stream clean-ups, and fund raising activities.

One example of how watershed-based approaches integrate with public involvement is the voluntary clean up of abandoned mines in the Mineral Basin district of American Fork Canyon, Utah, where the private non-profit Trout Unlimited organization is partnering with Snowbird Ski Resort and U.S Forest Service to accomplish clean up and stabilization of the abandoned Pacific Mine and other areas. Another example is development of cost-share arrangements between public and private organizations in Little Cottonwood Canyon to upgrade, re-construct and operate the Alta Wetland Fen, which treats acid drainage from the abandoned Columbus Rexall mine. Both projects have achieved extensive monitoring prior to the development of a TMDL and initiation of restoration efforts.

Figure 42. Watersheds in Utah



VI. GOALS AND OBJECTIVES

The goals and objectives listed below can only be accomplished in the specified time frame if sufficient funds are allocated to these action items and if the regulatory climate encourages local and government participation.

Goal 1 In association with TMDL development, conduct watershed reconnaissance studies for impacted watersheds to assess and characterize mining-related NPS problems and to identify threats to water quality.

Objective 1. Identify and determine restoration goals in watersheds impacted by mining related NPS pollution

Task 1	Use the 303(d) list and the 305(b) report to focus the inventory in conjunction with TMDL development. (biennially)
Task 2	Conduct outreach activities during TMDL development to solicit input from local stakeholders and public on watershed concerns. (ongoing)
Task 3	Consult with federal and state agencies for input on problem identification and solutions during development of TMDLs. (According to TMDL
Task 4	Identify sources of radioactive nonpoint pollution sources in conjunction with appropriate TMDLs. (biennially)

Figure 43. Cement Creek, Animas Basin, CO.

Objective 2. Conduct source characterization studies for watersheds impacted by mining related nonpoint sources as part of relevant TMDL development as scheduled.

Task 5	Conduct stream and mine discharge characterization studies
Task 6	Conduct mine waste rock and tailings characterization studies.
Task 7	Conduct mine groundwater pathways characterization studies.
Task 8	Conduct aquatic and biological assessments of targeted watersheds.
Task 9	Conduct background loading studies for targeted watersheds.

Objective 3. Rank and prioritize individual mine sites for reclamation and water quality improvement projects as part of **TMDL/ Watershed plans.**

Task 10	Use source characterization data in conjunction with aquatic and biological assessment, background loading investigations, public input and cost benefit analysis to prioritize sites for reclamation. (biennially)
Task 11	Mining Technical Advisory Committee meets annually to review proposals for 319 funding.

Goal 2 ***Protect surface and groundwater by developing and implementing water quality restoration and preservation projects using BMPs to:***

> ***A) return streams impacted by mining to designated uses***
> ***B) prevent significant threats to water quality from***

Objective 1. Develop water quality restoration and preservation projects for mine sites that have been characterized as high priority.

Task 12 Use site characterization and water quality data to determine existing applicable BMPs or develop new BMPs for use in water quality projects. (biennially)

Task 13 Develop partnerships to promote, create and implement demonstration projects. (ongoing)

Figure 44. Dutchman Flat Repository, American Fork Canyon, UT. Placement of tailings into repository.

Objective 2. Implement Best Management Practices at mine sites that have been characterized as a high priority for watershed restoration or

Task 14 Assist project sponsors in obtaining funding for mining related water quality reclamation and improvement projects from a wide range of sources including State Revolving Loan funds, severance tax funds, U.S. Office of Surface Mining, cost sharing and CWA Section 319 funds. (annually)

Task 15 Conduct abandoned mine watershed restoration and demonstrations projects. (ongoing)

Objective 3. Monitor selected NPS mining projects following grant approval and evaluate the success of Best Management Practices.

Task 16 Enter mid-year & annual reports from project sponsors into the EPA Grants Reporting and Tracking System (GRTS). (annually)

Task 17 Project sponsors will monitor selected completed NPS 319 water quality reclamation and improvement projects and compile results in final project reports. (complete reports within six months following project completion)

Goal 3 Build long-term partnerships to enhance cooperation between industry, environmental groups, and government in restoration of abandoned mine lands.

Objective 1. Foster and support a regulatory framework within which industry and private groups can participate in water quality restoration or preservation projects with appropriate liability protection.

Task 18 Support Good Samaritan legislation by providing information to Legislators, Congress and other policy-making bodies on nonpoint source issues, particularly those related to mining.

Task 19 Support restoration of abandoned mine sites by assisting landowners or other interested parties. (ongoing)

Objective 2. Encourage local participation in water quality restoration and preservation pro-

Task 20 Encourage volunteer opportunities at mining NPS projects. (annually)

Task 21 Assist in the formation and support of watershed groups by providing information and technical assistance. (ongoing)

Objective 3. Actively support federal agency efforts to improve and protect water quality in Utah within jurisdictional lands.

Task 22 Coordinate with and support federal agencies in efforts to identify and implement water quality restoration and preservation projects. (ongoing)

Task 23 Meet annually with representatives of federal agencies to share information and develop strategies to assure compliance with State goals and objectives.

Task 24 Coordinate with appropriate land management agencies for cooperative monitoring activities in stream segments identified on the 303(d) list and others as negotiated. (annually)

Objective 4. Actively administer, participate in and support the Abandoned Mine component

Task 25 Serve on the Abandoned Mine Advisory Committee to the NPS Task Force and advocate appropriate demonstration and watershed projects that pertain to mining related nonpoint source pollution. (annually)

Task 26 Review and update the Mining Nonpoint Source Management plan as needed. (schedule 2010)

Figure 44. Mountain Bluebell wetland in Honeycomb Canyon, Brighton, UT.

Goal 4 ***Educate and inform target audiences regarding all aspects of NPS Mining Projects.***

Objective 1. Facilitate transfer and dissemination of 319 mining project results.

Task 27	Provide GRTS standard reporting format to project sponsors. (annually)
Task 28	Participate in local watershed committees. (ongoing)
Task 29	Coordinate and attend field trips, workshops and conferences. (ongoing)
Task 30	Solicit mining NPS stories when available for Utah Watershed Review. (annually)

Figure 46. Emma Mining District, Alta, UT.

Table of Milestone Dates for State Goals and Objectives

GOALS	TASKS	TIMEFRAME
1. Watershed Reconnaissance in association with TMDL dev.	1. Focus water quality inventory using 303(d) and 305(b) reports	Biennially
	2. Conduct outreach activities during TMDL development	Ongoing
	3. Consult with federal and state agencies for problem identification and solution during TMDL development	TMDL Schedule
	4. Identify sources of radioactive NPS pollution in conjunction with appropriate TMDLs	Biennially
	5. Conduct stream and mine discharge studies	TMDL Schedule
	6. Conduct mine waste rock and tailings characterization studies	TMDL Schedule
	7. Conduct mine groundwater pathway characterization studies	TMDL Schedule
	8. Conduct aquatic and biological assessment studies	TMDL Schedule
	9. Conduct background loading studies	TMDL Schedule
	10. Prioritize sites for reclamation	Biennially
	11. Meetings of Mining Technical Advisory Committee	Annually
2. Develop and Implement Water Quality Restoration and Preservation Projects	12. Determine existing applicable BMPs or develop new BMPs for use in water quality projects	Biennially
	13. Develop partnerships to promote, create and implement demonstration projects	Ongoing
	14. Assist project sponsors in obtaining funding	Annually
	15. Conduct abandoned mine watershed restoration and demonstration projects	Ongoing
	16. Enter mid-year and annual reports from project sponsors into EPA GRTS	Semi-annually
	17. Monitor selected completed NPS 319 water quality reclamation and improvement projects and compile results in final project reports	Six months following project completion

3. Build Long-Term Partnerships	18. Support Good Samaritan Legislation by providing information	As requested
	19. Support restoration of abandoned mine sites	Ongoing
	20. Encourage volunteer opportunities	Annually
	21. Assist in the formation and support of watershed groups	Ongoing
	22. Coordinate with and support federal agencies in efforts to identify and implement water quality restoration and preservation projects	Ongoing
	23. Meet with representatives of federal agencies to share information and develop strategies to assure compliance with state goals and objectives	Annually
	24. Coordinate with land management agencies for cooperative monitoring activities	Annually
	25. Serve on Abandoned Mine Technical Advisory Committee and advocate implementation projects	Annually
	26. Review and update Mining NPS Management Plan as needed	2010
4. Educate and Inform Target Audiences	27. Provide GRTS standard reporting format to project sponsors	Annually
	28. Participate in local watershed committees	Ongoing
	29. Coordinate and attend field trips, workshops and conferences	Ongoing
	30. Solicit mining NPS stories to publish in the Utah Watershed Review	Annually

VII IMPLEMENTATION

The Nonpoint Source Program brings together regulatory, non-regulatory, voluntary, and incentive efforts to improve water quality. Some of the regulatory tools defined in the Clean Water Act and Comprehensive Environmental Response Compensation and Liability Act (CERCLA) can help watershed groups or agencies define priorities and find environmentally sound possible solutions for response projects. However, some of the most significant impediments to advancing voluntary and incentive-based projects are related to regulatory issues. Some of the tools available for remediation of abandoned mining sites are discussed below.

Federal and State Initiatives/Financial Resources

Federal land management agencies are completing inventories of abandoned mines on their lands and have identified the most significant water quality problems. Agencies such as the U.S. Bureau of Land Management, U.S. Forest Service and the U.S. Geological Survey have established agency funding sources for characterization and remediation of mining-related nonpoint sources of pollution located on federal lands. Notably, many of these funding sources are for agency projects only.

In addition, Federal Agencies are to report "most significant water quality problems" to the Federal Agency Hazardous Waste Compliance Docket as identified in CERCLA Section 120 (c.) and under Section 103 of CERCLA. Notably, "most significant water quality problems" are to be identified in the Federal Register and reported under the Federal Agency's response authorities (CERCLA 104).

Federal agencies such as the Environmental Protection Agency provide funds for nonpoint source work with Clean Water Act (CWA) Section 319 grant funds and regional Geographic Initiative Grants [CWA Section 104(b)(3)]. Funds are available through the U.S. Office of Surface Mining (OSM) to address problems related to past mining operations. The funds come from fees paid by current coal mining operations. The fees are placed in a trust fund by OSM and are disbursed to states with approved programs for reclamation projects. In Utah the funds are administered by the Utah DOGM, Abandoned Mine Reclamation Program (AMRP). OSM funds are not restricted to coal mine reclamation, but subject to certain limitations for use at mines for other commodities.

Reclamation Projects Funded by DOGM

The Division of Oil, Gas and Mining (DOGM) has conducted several notable watershed projects recently. Examples of these projects include:

- The Cottonwood Wash Project is a multi-year, multi-agency (AMRP, BLM, USFS) project to reclaim abandoned uranium mines in Cottonwood Wash, west of Blanding. It removed mining wastes from stream channels, closed mine openings, reclaimed roadways, and re-vegetated disturbed lands.

- The Price River Coal Pile Project (Phases 1-3) removed approximately 350,000 cubic yards of coal refuse from the bank of the Price River (Carbon County). This coal was washing into the river during spring runoff and causing problems for downstream water users.

- The Lower Willow Creek Project removed approximately 100,000 cubic yards of coal refuse from the floodplain of Willow Creek (Carbon County).

- The Castle Gate Sed Ponds Project removed approximately 26,000 cubic yards of coal wash plant residue from the floodplain of Price River (Carbon County).

- The Standardville Project removed coal refuse from about three miles of stream channel in Spring Canyon (Carbon County).

The AMRP has restored hundreds of acres of disturbed, eroding mined lands to productive uses.

Notably, a lot of DOGM;s coal reclamation in the 1980s and 1990s had a significant water quality component. Additionally, most of DOGM's noncoal work has been public safety-oriented shaft and adit closures, due to the restrictions for noncoal reclamation attached to the OSM funding. Cottonwood Wash was an exception, due to the alternative funding.

Figure 47. Dutchman Flats site in American Fork Canyon, Utah County, UT—prior to repository construction..

Comprehensive Environmental Response Compensation and Liability Act (CERCLA)

CERCLA, (the Statute, called SUPERFUND) has been used to achieve dramatic remediation results, and provides an overarching framework for all environmental clean up. CERCLA, as the "umbrella Federal Law" can be utilized for clean up of environmentally impacted abandoned mine sites, whether located on private, state, or Federal land. The real effectiveness in CERCLA is its all encompassing joint and several liability legal authorities ability to pursue Potentially Responsible Parties (PRPs).

The intent of Congress was to have the polluter pay the costs involved in remediation. However, CERCLA allows for the small contributor to the contamination to "de minimus" out of major fiscal liability. However, the burden to prove a de minimus claim falls to the responsible parties, usually not the government, to work out, and if needed, arbitration in a court of law.

CERCLA actions are taken principally at National Priorities List (NPL) sites, and only after the PRP have been notified. When recalcitrant PRPs refuse to take responsibility, legal action, which usually entails monetary settlements, are considered part of the corrective action. At abandoned mining sites, it would be beneficial to work under the CERCLA planning and assessment framework to further enhance meaningful and good intentioned environmental efforts under the Clean Water Act (CWA) Section 319.

Under CERCLA, States (when liable, or as PRP) have similar responsibilities to participate in environmental clean up as private responsible parties. The same is true of Federal Agencies. In Section 120 of CERCLA, Congress imposed on all Federal Agencies the responsibility for the mitigation of release, or threat of release, of Hazardous Substances and subsequent environmental impacts [CERCLA Section 101(14) and Section 103]. Additionally, the land/facility(s) that are managed by Federal Agencies were given similar responsibility. Notably, on Federal lands, liability is assessed by the Department of Justice on Federal Agencies. CERCLA makes provision for a Section 120 agreement to decide legal action. This 120 Agreement is usually onerous and precludes cooperative working relationships. The Section 120 Agreement is similar to the legal instrument used for private party Order on Consent. As intended by Congress, the Federal Agency, under the Section 120 agreement is expected to comply with CERCLA.

Clean Water Act Authorities

The Clean Water Act provides opportunities for control of abandoned mining sites through several different means, but it also presents enormous challenges in terms of instituting passive treatment facilities from draining adits and tunnels, and difficult challenges for dealing with stormwater pollution. The Clean Water Act provides authority for the permitting of nearly all aspects of pollution at inactive mining sites; however, the practical reality of instituting such permits generally makes this option unattainable. Often individuals who never benefited from production of the mines own these sites, and because the mine is inactive, there is no source of funds generated by the facility to provide for treatment. The Section 319 program offers an opportunity in these difficult situations to assist with these problems.

Perhaps the most difficult obstacle to overcome in trying to treat drainage from adits and tunnels at abandoned sites is fear of liability. The fear of liability prevents any agency or party unassociated with these sources from becoming involved in their remediation. Section 319 funding can be very helpful in pursuing remediation at mining sites where both the CERCLA and Clean Water Act liability concerns can be accommodated. Occasionally, this requires specific Administrative Orders on Consent (AOC) with the EPA. Storm-water permits may be required by the State to allow the work to proceed. States push the fines, conditions, and the imposition of standards. Notably, the EPA has an oversight role in this situation.

Figure 48. Livingston Mill near Stanley Idaho.

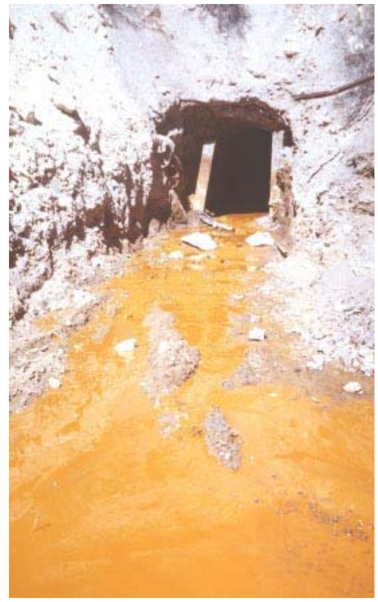


Figure 49. Adit mine drainage at Lower Colorado adit, near Markleville, California.

Good Samaritan Legislation

There is currently no provision in the Clean Water Act that protects participants from liability in reclamation projects that treat surface or groundwater impacted by mine-related NPS pollution. The EPA, environmental organizations, the mining industry, and other western states have made concerted efforts to draft "Good Samaritan" legislation addressing liability issues. In late September 2004, Senator Campbell introduced a Good Samaritan Abandoned and Inactive Mined Lands Remediation Act (S. 1660) with Senators Allard (R-CO), Ensign (R-NV), Hatch (R-UT) and Reid (D-NV). This act would authorize the EPA to issue a remediation permit if an applicant meets certain requirements. The bill has been referred to the Environment, Public Works Committee. The proposed legislation outlines reasonable conditions for obtaining and terminating the permit and has support from environmental coalitions. It is hoped that the Congress will favorably address this issue. In the meantime, Utah is continuing to work with EPA and other regulatory agencies to assess and characterize specific mining NPS problems and, in certain cases, implement reclamation projects.

Voluntary Clean-up Program

The Utah State Legislature passed the Voluntary Release Cleanup Program statute during the 1997 legislative session. This legislation created the Voluntary Environmental Cleanup Program (VCP) under the direction of the Utah Department of Environmental Quality (UDEQ), effective May 5, 1997. The purpose of the program is to encourage the voluntary cleanup of sites where there has been a contaminant release threatening public health and the environment, thereby removing the stigma attached to these sites which blocks economic redevelopment. Voluntary cleanup of these sites will hopefully result in clearing the pathway for returning these properties to beneficial use (http://www.environmentalresponse.utah.gov/).

Figure 50. Historic Ball Mill in Animas Basin, CO.

Implementation Milestones

The success of the Mining Technical Advisory Committee and the NPS Task Force are dependent upon the ongoing pursuit of the goals and objectives previously outlined. The structure of the organization must be flexible and capable of responding to new technological, political, and cultural events. In order to accomplish the goals and objectives of the NPS Task Force and the State, the Mining Technical Advisory Committee will continue to:

1. Function as a distinct group of individuals, government entities and other stakeholders who have an interest in the special issues related to mining-related NPS pollution. Because of the diversity of the problems related to mining NPS pollutants, the solutions may be technologically complex and vary according to the site. The Mining Technical Advisory Committee can provide a forum for the discussion of mining issues and the development of solutions and project plans while recognizing the impacts that mining has on other features of a watershed.

2. Function as part of the larger group of individuals, government entities and stakeholders whose mission is to address all categories of NPS pollution throughout the entire state. The Mining Technical Advisory Committee participates in the development and implementation of policies and procedures that address all NPS issues.

3. Assist in obtaining and delegating funds for reclamation projects that address NPS pollution.

Authorities and Jurisdiction

To further protect Utah's waters from nonpoint source pollution originating from abandoned mines, the following is a compilation of the authorities and jurisdictions, legally established, for federal, state, and local agencies and organizations that have jurisdiction over nonpoint source pollution and mining related issues. Where applicable, individual agencies and/or organizations have provided the governmental mandate whereby their authorities have been granted.

Federal Agencies

United States Environmental Protection Agency

Environmental Program Overview and Authorities

The Environmental Protection Agency (EPA) is responsible for the administration of seven Federal environmental regulatory laws: the Clean Air Act (CAA); the Clean Water Act (CWA); the Resource Conservation and Recovery Act (RCRA); the Comprehensive Environmental Response and Compensation Liability Act (CERCLA); the Toxic Substances Control Act (TSCA); the Safe Drinking Water Act (SDWA); and, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). An eighth Federal law, the National Environmental Policy Act (NEPA) requires EPA to review all Federal actions that could adversely affect human health or the environment.

Though all the above laws could apply to activities at a mine site, few actually apply to the environmental effects caused by an abandoned mine. CERCLA and NEPA will apply to an abandoned mine site if a Federal agency is planning any removal or remedial actions at the site. The CWA can apply to waters issuing from an abandoned mine site whether there are any ongoing activities or not, Federal or otherwise. SDWA may apply when the abandoned mine site is in a source water area for a public drinking water supply. All of these laws are intended to protect the environment and human health from adverse effects that occur from human activities, whether those activities have occurred in the past, are currently ongoing, or are being planned.

Abandoned Mine Lands

NEPA and CERCLA may apply to actions that a Federal agency decides to conduct at an abandoned mine site. Certain actions, such as silvicultural, or road or quarry expansions, may require an evaluation conducted under NEPA. Other actions, such as a long-term plan to clean up mine wastes would be governed by CERCLA, and CERCLA-based rules would have to be followed. In other cases, the Federal land managing agency or EPA may decide the mine wastes pose an imminent and substantial threat to the environment or human health. In these instances, CERCLA provides for emergency actions to be undertaken to remove the threat. Again, CERCLA-based rules would have to be followed to conduct the removal action.

Sometimes, the mine wastes themselves don't pose an imminent threat, and the only pollution coming from the abandoned mine are surface waters discharging to another body of water. The CWA may apply in these circumstances. If pollutants are being discharged from the abandoned mine site to Waters of the US, then the CWA is applicable. Usually, at an abandoned mine site, the owner of the land is responsible, under the CWA, for the discharges of pollutants. If, for example, the abandoned mine is on US Forest Service land, then the Forest Service would be the responsible land managing agency for the Federal government.

United States Environmental Protection Agency—Continued

The CWA requires that all point source discharges of pollutants to Waters of the U.S. obtain a permit. The permit will set limits to those discharges and require monitoring to ensure that water quality standards are being met. At an abandoned mine site, **only discharges from a draining adit are considered to be a point source discharge**, and therefore, required to be covered under a discharge permit. Generally speaking, all other waters naturally issuing from the abandoned mine carrying pollutants to Waters of the US are considered to be NONPOINT SOURCES of pollution. There are exceptions, of course, too numerous to mention here.

Figure 51. Historic mining town site, Alta, UT.

Each of these laws also provide some funding for activities that may help improve the environment, educate the public, or make a project more environmentally friendly. Section 319 of the Clean Water Act provides funding to States, and certain organizations or individuals, that may wish to mitigate the effects from nonpoint sources of pollution. The regulations promulgated in accordance with Section 319 require that the State follow an approved management plan when conducting such activities to mitigate the effects from nonpoint sources in order to qualify for funding under the CWA. The State of Utah has written this addendum in order to use Section 319 grant funds for activities conducted at non-Federal abandoned Mine Lands.

There are many sources of funding for projects meant to improve the environment at an abandoned mine land. Some are for watershed activities, some just for clean rivers, or improving fish or wildlife habitat, or to help protect drinking water source areas, or for flood mitigation assistance, or not-for-profit mine drainage, and many, many more. For more information, EPA's catalog of Federal Funding Sources for Watershed Protection is a good place to start.

The internet address for the catalog web site is:
http://cfpub.epa.gov/fedfund

United States Department of Agriculture—Forest Service

Minerals Program Overview and Authorities

The Intermountain Region of the Forest Service (FS) covers the states of Nevada, the Bridger-Teton National Forest in Wyoming, Utah, and central and southern Idaho and laps over into Colorado through the Manti-La Sal National Forest and into California. The minerals and geology program in the Intermountain Region of the Forest Service is divided into the following program areas:

<u>Locatable Minerals</u>

Includes "hardrock" minerals such as gold, silver, and copper. They are disposed of under the authority of the General Mining Law of 1872 as amended. Locatable minerals are unique in that the right to explore for and develop these minerals is granted by statute. The Forest Service may regulate the surface resource impacts of such activities but not deny or materially interfere with them. Hardrock minerals on acquired lands are disposed of by lease rather than under the authority of the 1872 Mining Law. The surface use of operations conducted on mining claims located under the Mining Law of 1872 is governed by regulations found at 36 CFR 228, subpart A, for National Forest System lands. Notably, Executive Order 13016 gives CERCLA 106 authorities to the Federal Land Management Agencies and a national Memorandum of Understanding (MOU) exists between the Forest Service and the EPA. As required by regulations, mining claimants and their operators are responsible for reclamation of mining disturbances created at their sites.

Figure 52. Mine waste site near Sheeprock Mountains, south of Vernon in Tooele County, UT.

<u>Leasable Minerals</u>

Oil and gas, phosphate, coal and geothermal resources are typical. Right to develop is granted by leases issued by the Bureau of Land Management. Forest Service may provide BLM with leasing recommendations in some cases (phosphate), and has consent authority on others (oil & gas, coal, geothermal). Once leases for oil and gas are issued, FS manages surface resource impacts of exploration/development, while BLM and the Office of Surface Mining (OSM) is responsible for subsurface activities. For solid leasable minerals, BLM manages exploration and development.

<u>Salable Minerals</u>

Salable materials, also referred to as common variety or mineral materials, include commodities like sand, gravel, cinders, rip rap and other materials whose value does not depend on unique physical or chemical properties. The Materials Act of July 31, 1947 provided for the disposal of mineral materials on the public lands through bidding, negotiated contracts, or free use. This is the one class of mineral over which the Forest Service has full authority.

Contact information:
U.S.D.A. Forest Service
Intermountain Region
BioPhysical Resources
Minerals Program Management
324 25th Street
Ogden, UT 84040

Director: William LeVere
Deputy Director of Minerals & Geology: Barry Burkhardt
Website: www.fs.fed.us/r4/mine_cleanup/r4_mine_cleanup.html

United States Department of Agriculture—Forest Service Continued

Mine Cleanup Program

The hazardous materials component of the minerals program is increasing in importance. The primary emphasis of this program is the identification and restoration of National Forest System lands disturbed by abandoned mineral activities and the protection of forest resources from releases of hazardous substances.

Geology Program

The geology program covers the Region's following areas: geologic hazards, groundwater, paleontology, and forest planning.

Mine Cleanup Budget

The Forest Service receives funding for mine hazardous substance cleanup, reclamation, and safety closures at abandoned mine sites through a variety of sources. One source is directly from the U.S. Department of Agriculture, Hazardous Waste Management Group, in Washington, D.C., where funds are set aside at the Department level for cleanup of sites contaminated by hazardous substances. A second source is through the Forest Service Washington Office engineering staff in charge of the environmental compliance program. A third source is from the Forest Service Washington Office Minerals & Geology staff for reclamation and safety closures. All three of these programs require national competition for the funds.

Authorities for Abandoned Mine Cleanup

The Forest Service makes abandoned mine cleanup decisions based on the process of Federal Agency Hazardous Waste Compliance Docket, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) at sites that involve hazardous substances. The hazardous substances are identified in CERCLA section 101 (14) and is inclusive of nearly all Federal Laws. Chemicals, reagents, and heavy metals are all hazardous substances under the authority and direction of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); as amended by the Superfund Amendments and Reauthorization Act, 42 U.S.C. §9601 et seq; 42 U.S.C. §9604, 9622(a) and 9622 (d)(3); Executive Order (EO) 12580, Title 7 Code of Federal Regulations (CFR) 2.60 (a)(40); Forest Service Manual (FSM) 2164.04 c, 2.1, effective November 10, 1994.

In order to review Removal Actions, consistent with the National Oil and Hazardous Substance Contingency Plan (NCP) 40 CFR 300, please visit http://www.epa.gov/epacfr40/chapt-I.info/chi-toc.htm.

Removal actions must be consistent with CERCLA 120 (a)(4), and 120 (c) and (d). For safety closures, reclamation, and other actions at mines not involving hazardous substances, all federal agencies are required by the National Environmental Policy Act (promulgated in 1970; 42 U.S.C. Section 4321; 40 CFR Part 1500-1508) to analyze proposed actions involving federal lands and their potential effects. See http://ceq.eh.doe.gov/nepa/regs/nepa/nepaeqia.htm. As a minimum, the Federal Agency should be coordinating the applicable sections in 40 CFR 300.405, 410, and 415 with the EPA before environmental or human health decisions are initiated.

For Forest Service mineral regulations, except for mine cleanup, refer to:
http://www.access.gpo.gov/nara/cfr/waisidx_00/36cfr228_00.html

United States (U.S.) Department of Interior—Utah Bureau of Land Management

Solid Minerals Program

The jurisdiction of the Utah Bureau of Land Management, Solid Minerals Program is management of solid mineral resources on public lands throughout the State of Utah. Our authority for managing public lands is the Federal Land Policy and Management Act of 1976, as amended (43 U.S.C. 1701 et seq.). This Act requires BLM to manage public lands to prevent unnecessary or undue degradation of Federal lands.

Currently, Federal minerals are classified into one of three categories: (1) locatable minerals; (2) leasable minerals; and (3) salable minerals. Each of the mineral categories has additional specific authorities and regulations that mandate how they are managed. As they apply to Utah, the definition and pertinent regulations are as follows:

Locatable Minerals

Locatable minerals are uncommon varieties of sand, stone, gravel, cinders, pumice, pumicite and clay and all valuable minerals such as gold, silver, uranium, vanadium, etc. not listed as leasable or salable minerals below. The main regulations for managing locatable exploration and mineral development are: Surface Management (43 CFR 3809), Exploration and Mining, Wilderness Review Program (43 CFR 3802) and Use and Occupancy under the Mining Laws (43 CFR 3715). The Surface Management regulations require the submission of a plan of operations or a notice and an associated financial guarantee for the mining activity as approved or accepted prior to the disturbance occurring on the ground.

Abandoned mines are mining activity that occurred prior to January 1, 1981 (effective date of the Surface Management regulations). The majority of the abandoned mines that will be addressed under this management plan are pre-regulation locatable mineral activity. If a mining claim exists on an abandoned mine, the mining claimant of record is given the opportunity to take reclamation responsibility for the mine site. If the mining claimant takes responsibility for the abandoned mine then they must comply with the Surface Management regulations and file a notice or plan of operations and a financial guarantee. If they do not, or will not take reclamation responsibility for the abandoned mine disturbance on a post-1955 mining claim, then BLM may take the necessary steps to protect public safety and prevent further unnecessary and undue degradation caused by the abandoned mine site. Our authority for this action is the Surface Resources Act of 1955 (30 U.S.C. Section § 612(b)). The Clean Water Act of 1972, as amended (33 U.S.C. 1251 et seq.) is considered another general authority to promote cleanup of AML sites that adversely affect watersheds.

An abandoned mine with a release of a hazardous substance also has additional authorities that include the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. 9601 et seq. and the National Contingency Plan Regulations (40 CFR 300). By Secretarial Order BLM has been delegated the authority to initiate removal or remedial actions for release or threat of release of hazardous substances. CERCLA has two main types of responses which are: removal response and/or remedial response. Removal responses are usually a short term immediate action taken to prevent, minimize, or mitigate damage to the public health or welfare or to the environment. They can be emergencies or time-critical or non-time critical actions. A remedial response is a long-term action that is a permanent remedy to a release of hazardous substances. Sites of large magnitude, as listed on the National Priorities List (NPL), are usually cleaned up with a remedial response. Depending on the situation, there may also be cleanup response authorities under the Resource Conservation Recovery Act (RCRA) of 1976 (42 U.S.C. 6991 et. seq.) for unauthorized landfills and underground storage tanks. BLM can also utilize the Toxic Substance Control Act of 1976 (15

United States (U.S.) Department of Interior—Utah Bureau of Land Management Continued

U.S.C. 2601 et. seq.) to respond to asbestos, radon and lead based paint found at abandoned mine sites.

In addition, the Wyden Amendment (PL 104-208, sec. 124, PL 105-277, sec. 136) which promotes watershed restoration and enhancement is another authority that BLM can use. Federal funds can be applied to lands owned by private, state, tribal or local entities. However, expenditures on the private land must be in the public interest and have direct benefits to biological resources on public land administered by BLM. The national strategy for evaluating and approving requests for funding and implementation criteria are provided in instruction memorandums. Use of this authority requires a partnership agreement and an MOU with the state.

Leasable Minerals
Leasable Minerals are all minerals except salable minerals on acquired lands, coal, phosphate, oil, gas, chlorides, sulphates, carbonates, borates, silicates or nitrates of potassium and sodium, native asphalt, solid and semi-solid bitumen and bituminous rock and geothermal resources. Leasable mineral regulations are as follows: Geothermal Resources Leasing (43 CFR 3200), Coal Management (43 CFR 3400), Leasing of Solid Minerals Other Than Coal and Oil Shale (43 CFR 3500) and Oil and Gas Leasing (43 CFR 3100). Only very old leases become abandoned mine sites. The vast majority of these types of mining operations are adequately reclaimed through lease terms and conditions, mine permit authorization or bond forfeitures.

Salable Minerals
Salable minerals are common varieties of sand, stone, gravel, cinders, pumice, pumicite and clay. The 43 CFR 3600 regulations establish procedures for the exploration, development, and disposal of mineral material resources on the public lands. These regulations provide for the environment as well as the protection of the resource. Mineral materials are disposed of through permits for free use or contracts for sale. As reclamation practices have become standard operating procedures for all mining activity, few if any of these types of operations become abandoned mines.

Funding
Through our budget process funds are allocated for abandoned mine water quality issues. In addition, a small amount of funds are provided for physical safety mitigation. The budget process requires planning of abandoned mine identification, characterization and reclamation/remediation at least 2 years out in order to obtain funding for a project. The Utah BLM works very closely with the State of Utah, Division of Oil, Gas and Mining, Abandoned Mine Reclamation Program to resolve not only physical safety issues but environmental issues as well at abandoned mine sites located on BLM administered lands. This working relationship allows us to leverage our funds to the maximum extent possible.

There are two additional sources of funding available to BLM. They are the Special Cleanup (SCF) Fund and the Central HAZMAT Fund (CHF). The SCF is a BLM fund that requires submission of an application. All BLM offices nationwide compete for this funding. Projects are selected on merit. The CHF fund is a Department fund. Submission of an application is also required. All Department of Interior agencies compete for this funding. In addition, projects are selected on merit. The project selection criteria is as stringent, if not more stringent, than for SCF.

Contact Information:
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Utah State Office
440 West 200 South, Suite 500
Salt Lake City, UT 84101
Mailing address:
Bureau of Land Management
Utah State Office
Post Office Box 45155
Salt Lake City, UT 84145-0155

United States (U.S.) Department of the Interior – U.S. Geological Survey

The Utah District of the U.S. Geological Survey (USGS) is a non-regulatory agency that provides science-based information to public as well as Federal, State, and local regulatory and land-management agencies. The information can aid in making decisions regarding mine-drainage issues. Data on the chemical composition of both water and rocks are available in many different data bases (http://usgs.gov).

The principal program related to mining has been the Toxic Substances Hydrology Program (http://toxics.usgs.gov). Beginning in 1986, the program focused on metal transport in streams affected by mining, with the overall goal to provide improved information and tools to support decisions related to management, risk assessment, remediation planning, and mitigation of the anthropogenic effects of mine drainage on watersheds and ecosystems. The focus of this research is two-fold: (1) To characterize hydrologic and biogeochemical processes that affect dispersal of metals and associated contaminants, and (2) to detail contaminant pathways to organisms. Results will support science-based decisions that will be cost effective and lasting, and could lead to new methods of remediation. The approach has been to study chemical processes within the hydrologic context of a watershed, using a two-step approach. First, instream experimentation has provided data about the processes affecting metals. Second, development and application of solute transport models has helped to quantify rates and processes. Tracer-injection studies have been used in the design of methods to characterize mass loading from mining activities on a watershed scale. As part of the USGS Abandoned Mine Land Initiative (http://amli.usgs.gov), additional mass-loading studies began in support of the planning needs of Federal land management agencies. In Utah, mass-loading studies in Little Cottonwood Creek, American Fork Canyon, and Silver Creek have helped Federal and State agencies with decision making.

Contact information:
U.S. Department of the Interior
U.S. Geological Survey
Utah District
2329 W Orton Cir
West Valley City, UT 84119
801-908-5000

District Chief: Patrick Lambert
(plambert@usgs.gov)
Web: http://ut.water.usgs.gov/
Toxics project chief: Briant Kimball
(bkimball@usgs.gov)

State Agencies

Utah Division of Oil, Gas and Mining (DOGM)

The Utah Division of Oil, Gas and Mining (DOGM) in the Department of Natural Resources regulates exploration for and development of Utah's oil, gas, coal and other mineral resources. When exploration and developmental activities are completed, the division ensures that oil and gas wells are properly abandoned and mining sites are satisfactorily reclaimed. The division's staff works diligently to provide service to the citizens of the State of Utah, while striving to maintain the delicate balance between environment and industrial development.

Organizationally, within DOGM there is a functional split between oil and gas on one side and mining on the other. On the mining side, there are three programs: the Coal Regulatory Program, the Minerals Regulatory Program, and the Abandoned Mine Reclamation Program.

Figure 53. Albion Basin in Little Cottonwood Canyon, UT.

Contact information:
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84116
801-538-5257

Legal Authority: 40-6, 40-8, 40-10 UCA
Rules: R641-649 UAC
Division Director: Lowell P. Braxton
Associate Director for Mining: Mary Ann Wright
Website: http://www.ogm.utah.gov/

Coal Regulatory Program (CRP)

Legal Authority: 40-10-1 UCA
UCA Online:
http://www.le.state.ut.us/~code/TITLE40/40_07.htm
Rules: R645 UAC
UAC Online:
http://www.rules.utah.gov/publicat/code/r645/r645.htm
Permit Supervisors: Pam Grubaugh-Littig and Wayne Hedberg
Website:
http://ogm.utah.gov/coal/Default.htm

The CRP regulates the environmental aspects of coal mining operations under the authority of Title V of the federal Surface Mining Control and Reclamation Act (P.L. 95-87) and corresponding State law. The CRP approves and monitors compliance with permits and reclamation plans for coal mining operations.

Division of Oil, Gas and Mining—Continued

Minerals Regulatory Program (MRP)

Legal Authority: Utah Mined Land Reclamation Act, 40-8-1 UCA
UCA Online: http://www.le.state.ut.us/~code/TITLE40/40_06.htm
Rules: R647 UAC
UAC Online: http://www.rules.utah.gov/publicat/code/r647/r647.htm
Program Administrator: Daron Haddock
Website: http://ogm.utah.gov/minerals/default.htm

The MRP regulates the environmental aspects of mines for minerals other than coal under the authority of the Utah Mined Land Reclamation Act passed in 1975. The purpose of the Act is to ensure all mining operations in the State include plans for reclamation of the lands affected. The MRP approves and monitors compliance with permits and reclamation plans for noncoal mining operations. Mining operations are broken up into three categories: large mine (more than five acres of surface disturbance), small mine (five acres or less of surface disturbance), and exploration. All mining operations within the state are required to bond for reclamation of surface disturbance with the MRP prior to beginning operations. The MRP does not regulate the extraction of unconsolidated sand, gravel, or rock aggregate—consolidated material is regulated. Additionally, the MRP does not regulate oil and gas, or geothermal steam; smelting or refining operations; off-site operations and transportation; or reconnaissance activities.

Abandoned Mine Reclamation Program (AMRP)

Legal Authority: 40-10-25 UCA
UCA Online: http://www.le.state.ut.us/~code/TITLE40/htm/40_07029.htm
Rules: R643 UAC
UAC Online: http://www.rules.utah.gov/publicat/code/r643/r643.htm
Program Administrator: Mark Mesch
Website: http://ogm.utah.gov/amr/default.htm

The AMRP reclaims mines of all commodities abandoned prior to 1977 under the authority of Title IV of the federal Surface Mining Control and Reclamation Act (P.L. 95-87) and corresponding State law. It is a nonregulatory program. Primary funding for AMRP activities comes from the federal Abandoned Mine Land Fund administered by the U.S. Office of Surface Mining and derived from a tax on current coal production. Additional funding comes from Utah legislative appropriations from general funds, partnerships with other state or federal agencies, and other sources. The AMRP operates with an annual construction budget of approximately $1.5 million.

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NOTES:
UCA = Utah Code Annotated (Utah state laws)
UAC = Utah Administrative Code (Utah state agency implementing regulations)

Utah Geologic Survey (UGS)

The Utah Geological Survey (UGS) is a non-regulatory agency within the Utah Department of Natural Resources. Organizationally, within the Utah Geological Survey there are five programs: Economic and Mineral Resources, Environmental Sciences, Geologic Hazards, Geologic Information and Outreach, and Geologic Mapping. Water-quality studies are performed within the Environmental Science Program, which can provide up to about $200,000 in in-kind match for outside-funded projects that provide at least a 50 percent match. The designation of "outside-funded" may include other governmental agencies.

Data

Utah Geologic Survey is the State agency charged with collecting, compiling, managing, and evaluating geologic data on the state's energy and mineral resources and is a good source of detailed geologic maps and information for a particular mining district. The data are available in hard copy from the UGS and increasingly as digital GIS files. A digital geologic map of the state is available (Hintze, et. al 2000) as are digital 30 x 60 minute-scale geologic resource maps including oil, gas, coal, and geothermal, in addition to mineral resources available in a 1999 UGS data compilation (Sprinkel, 1999). Many of the geologic maps of the 7.5 minute USGS quadrangle maps are available in digital format from the UGS. The UGS maintains the Utah Mineral Occurrence System (UMOS) database, containing information on approximately 8,900 metallic and non-metallic mines, prospects, and occurrences in Utah. The database includes about 5,300 metallic and industrial rock and mineral records and more than 1,000 uranium records. Nearly 2,000 of the UMOS records are for sand and gravel deposits.

Contact information:

Utah Geological Survey
1594 West North Temple, Suite 3110
P.O. Box 146100
Salt Lake City, Utah 84114-6100
801-537-3300

Duties

(A) Assist and advise state and local government agencies and state educational institutions on geologic, paleontologic, and mineralogic subjects.

(B) Collect and distribute reliable information regarding the mineral industry and mineral resources, topography, paleontology, and geology of the state.

(C) Survey the geology of the State, including mineral occurrences and ores of metals, energy resources, industrial minerals and rocks, mineral-bearing waters, and surface- and groundwater resources, with special reference to their economic contents, values, uses, kind, and availability in order to facilitate their economic use.

(D) Investigate the kind, amount, and availability of mineral substances contained in lands owned and controlled by the state, to contribute to the most effective and beneficial administration of these lands for the state.

(E) Determine and investigate areas of geologic and topographic hazards that could affect the safety of, or cause economic loss to, the citizens of the state.

Division Director: Richard G. Allis
Deputy Director: Kimm M. Harty
Environmental Sciences Program Manager: Mike Lowe
Website: http://www.ugs.state.ut.us/

Utah Geologic Survey (UGS) - Continued

(F) Assist local and state governments and agencies in their planning, zoning, and building regulation functions by publishing maps, delineating special earthquake risk areas, and, at the request of state agencies or other governmental agencies, reviewing the siting of critical facilities.

(G) Cooperate with State agencies, political subdivisions of the State, quasi-governmental agencies, federal agencies, schools of higher education, and others in the fields of mutual concern, which may include field investigations and preparation, publication, and distribution of reports and maps.

(H) Collect and preserve data pertaining to mineral resource exploration and development programs and construction activities, such as claim maps, location of drill holes, location of surface and underground workings, geologic plans and sections, drill logs, and assay and sample maps, including the maintenance of a sample library of cores and cuttings.

(I) Study and analyze other scientific, economic, or aesthetic problems as, in the judgment of the Utah Geological Survey (UGS) board, should be undertaken by the survey to serve the needs of the state and to support the development of natural resources and utilization of lands within the state.

(J) Prepare, publish, distribute, and sell maps, reports, and bulletins, embodying the work accomplished by the survey, directly or in collaboration with others, and collect and prepare exhibits of geological and mineral resources of the state and interpret their significance.

(K) Collect, maintain, and preserve data and information in order to accomplish the purposes of this section and act as a repository for information concerning the geology of the state.

Figure 54. Natural Alta re-vegetation of fen project.

(L) Stimulate research, study, and activities in the field of paleontology.

(M) Mark, protect, and preserve critical paleontologic sites.

(N) Collect, preserve, and administer critical paleontological specimens until they are placed in a repository or curation facility.

(O) Administer critical paleontological site excavation records.

(P) Edit and publish critical paleontological records and reports.

Utah Department of Environmental Quality; Division of Water Quality

Utah Water Quality Act - 19-5 Utah Code Annotated

The Water Quality Act (WQA) is the enabling legislation for Utah's water quality protection program. The act establishes the Water Quality Board, the Division of Water Quality and Utah's Water Quality Rules, Title R317, Utah Administrative Code. The following rules implement the provisions of the Water Quality Act.

Definitions and General Requirements - R317-1 Utah Administrative Code (UAC)

The general requirements define several important concepts relating to the regulation of mining operations. First, the rule prohibits an entity from discharging wastewater or depositing wastes or other substances in violation of the Utah Water Quality Rules, R317 UAC. Second, it requires any person who wishes to construct any device for treatment or discharge of wastewater, first obtain a construction permit. The application for a construction permit requires submittal of complete plans, specifications and other pertinent documents covering the proposed construction for review. The construction permit, along with the Utah Pollutant Discharge Elimination System (UPDES) and Groundwater Discharge permits are the primary mechanisms used by the Division of Water Quality (DWQ) for regulating various components of mining operations such as heap leach pads, mine waste and solution ponds, waste rock dumps, and pits.

Standards of Quality for Waters of the State - R317-2Standards of Quality for Waters of the State - U.A.C. R448-2 UAC

Utah's Water Quality Standards are the result of the development, review, revision and approval process outlined in 40 CFR 131 as authorized under Section 303 of the Clean Water Act (CWA). The water quality standards define the water quality goals of the State's water bodies, by designating the use or uses to be made of the water and by setting criteria necessary to protect those uses. State water quality standards are adopted to protect public health and welfare, enhance the quality of the State's water, and to serve the purposes of the CWA. The water quality standards are designed to, wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water and to take into consideration their use and value of public water supplies. The standards serve the dual purpose of establishing the water quality goals for a specific water body and serve as the regulatory basis for the establishment of water quality based treatment controls and strategies beyond the technology-based levels required by Sections 301(b) and 306 of the CWA.

Ground Water Quality Protection Rules - R317-6 UAC

A ground water discharge permit is required for any person or entity proposing to construct or operate a new facility which could result in a release of contaminants to ground water.

Utah's Ground Water Quality Protection Rules are based on three main regulatory concepts: to prohibit the reduction of ground water quality; to prevent ground water contamination, and; to provide protection based on different existing levels of groundwater quality. The rule consists of five main administrative components: ground water quality standards; ground water classification, ground water protection levels; aquifer classification procedures; and a ground water discharge

Department of Environmental Quality; Division of Water Quality—Continued

permit system. Utah's ground water protection regulations provide an anti-degradation policy for ground water protection. This policy provides for the maintenance and protection of current and probable future beneficial uses of ground water, protection of higher quality waters at their existing water quality, and prevention of degradation of water quality that would be injurious to existing or potential beneficial water use.

The ground water quality standards are numerical standards for potential ground water contaminants. These standards are based on the maximum contaminant levels (MCL's) established under the National Primary Drinking Water Regulations authorized by the Safe Drinking Water Act amendments of 1986 and the National Secondary Drinking Water Regulations as authorized by the Safe Drinking Water Act. For pollutants without standards in the regulations, numerical standards will be established on a case-by-case basis by the Utah Water Quality Board, based on the most current and scientifically valid information available. As new standards are developed for pollutants by EPA, they will be reviewed and considered for adoption.

The regulations allow permitting by rule for certain classes of activities which pose little or no threat to ground water quality or are permitted by another State agency. The following classes of mining activities are permitted by rule: 1) small mining operations (mining, processing, or milling facilities handling less than 10 tons per day of metallic or nonmetallic ore and waste rock, not to exceed 2500 tons/year in aggregate); 2) drilling operations for metallic minerals, nonmetallic minerals, water, hydrocarbons, or geothermal energy sources when done in conformance with applicable regulations of the Utah Division of Oil, Gas and Mining or the Division of Water Rights; and 3) natural ground water seeping or flowing into conventional mine workings which re-enters the ground by natural gravity flow prior to pumping or transporting out of the mine and without being used in any mining or metallurgical process. While facilities which fall into these classes are not required to obtain a ground water discharge permit, they are not allowed to exceed the ground water quality standards. Additionally, the Executive Secretary of the Water Quality Board can require a discharge permit for any facility or activity, exempt or not, if he determines that it constitutes a threat to ground water quality.

New facilities are required to apply best available technology to protect ground water, and in most cases, are designed to contain all pollutants and not allow a discharge.

Underground Injection Control (UIC) Program
R317-7 UAC

UIC Regulations are designed to ensure contaminants do not escape from wells into aquifers. Wells used to inject fluids associated with the production of oil and natural gas or fluids used for enhanced hydrocarbon recovery are regulated by the Division of Oil, Gas and Mining. All others are regulated by the Division of Water Quality. Most injection wells are authorized by rule and do not need individual permits but must submit notification. The Division of Water sets minimum construction, operating, monitoring, reporting, financial responsibility, closure and record keeping requirements for all permitted injection operations.

Department of Environmental Quality; Division of Water Quality—Continued

Utah Pollutant Discharge Elimination System (UPDES) - R317-8 UAC Utah Pollutant Discharge Elimination System (UPDES) - U.A.C. R448-8

Utah's Pollutant Discharge Elimination System is a federally based program resulting from the development, review, revision and approval process outlined in 40 CFR 123 as authorized under Sections 318, 402, and 405 of the CWA. Utah received primacy for the NPDES Program from EPA after demonstration that its program is no less stringent than the federal requirements. The UPDES Permit is the mechanism by which point discharges to the surface waters of the State are regulated. UPDES program requires permits for the discharge of pollutants from any point source into waters of the State. The program also applies to owners or operators of any treatment works treating domestic sewage and all industrial, municipal and federal facilities, except those on Indian lands. Besides typical municipal and industrial wastewater discharges, activities such as storm water discharges and construction dewatering require permits.

Contact Information:
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Division of Water Quality
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Location:
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Salt Lake City, UT
Phone: 801-538-6146
Fax: 801-538-6016
Website: www.waterquality.utah.gov

Storm Water Permits:

- General Industrial Storm Water Permit - Certain industrial facilities are required to be covered under the general industrial storm water permit. Facilities commonly covered in Utah are mines (including gravel pits), facilities that produce cement products, many wood product facilities, airports, junk yards, and scrap recycling facilities. Coverage is dependent on the facility's Standard Industrial Classification (SIC) Code.

- General Construction Stormwater Permit - Any construction that disturbs one acre of land or more needs either a UPDES Storm Water General Permit for Construction Activities or an alternate individual permit. Coverage under these permits must be obtained and erosion and sediment controls must be installed prior to any grading activities at a site.

Section 401 of the Clean Water Act of 1987 (PL 100-4)

The Federal Clean Water Act of 1987 requires any applicant for a federal license or permit to conduct any activity which may result in a discharge to the navigable waters of the United States shall provide the licensing or permitting agency a certification from the State that any such discharge will comply with the applicable provisions of sections 301 (Effluent Limitations), 302 (Water Quality Related Effluent Limitations), 303 (Water Quality Standards), 306 (National Standards of Performance), and 307 (Toxic and Pretreatment Effluent Standards) of the Act. Section 401 of the Act further states that no such license or permit shall be granted if certification has been denied by the State. The Section 401 review and certification process is routinely performed by DWQ on projects throughout the State.

Salt Lake County Public Works Department

County Authority

Salt Lake County is a political subdivision of the State of Utah and has those statutory powers delegated and implied to counties contained in Utah Code Ann., Title 17, Chapter 50. Unlike other political subdivisions, however, counties have statutory authority for flood control. In this regard, Section 17-8-5 provides that "... *all laws* and sanitary regulations against the *pollution of water in natural streams*, canals, and lakes shall be enforced by the county executives in their respective counties."

The Utah Water Quality Act, Section 19-5-107(1)(a) states that it is unlawful for any person to discharge a pollutant into waters of the state or to place or cause to be placed any wastes in a location where there is probable cause to believe it will cause pollution. The county has authority to enforce the prohibition on the discharge of pollutants under the Act, pursuant to the authority contained in Section 17-8-5.

Sections 17-18-1.5 and 1.7 provide that the county attorney shall appear for the State in the district court of the county in all criminal prosecutions. In addition, Section 26A-1-120(1) of the Local Health Department Act provides that the county attorney shall prosecute criminal violations of the public health laws and rules of the Departments of Health and Environmental Quality. Prosecution districts have been created under Section 17-16-2.5 in which the district attorney prosecutes crimes on behalf of the State.

Local Health Department

The Salt Lake Valley Health Department is a county health department organized pursuant to the Utah Local Health Department Act, Title 26A, Utah Code Ann., and has jurisdiction in all unincorporated and incorporated areas of the county. Section 26A-1-114 enumerates the powers and duties of a local health department. The Salt Lake Valley Health Department has adopted health regulations including Regulation #14 mandating the protection of water the watershed. In this regard, it should be noted that health regulation #14 is also incorporated in Chapter 9.24 of the Salt Lake County Code of Ordinances. The violation of a health regulation constitutes a class "B" misdemeanor.

Public Nuisance

Section 19-5-107(1)(b) of the Water Quality Act states that any violation of the prohibition on the pollution of waters of the state is a public nuisance. The Salt Lake Valley Health Department has authority under Title 26A to address any violation of the Act as a public nuisance. The District Attorney has authority under Section 76-10-806 to take legal action to abate a public nuisance.

Citizen Suit

Section 505 of the Federal Water Pollution Control Act (33 U.S.C.A. Section 1365) provides that any citizen may commence a civil action against any person who is alleged to be in violation of any effluent standard or limitation under the Act. The term "citizen" is defined in Section 505(g) and means any person having an interest which is or may be adversely affected. Under the terms of the citizen suit provision, a county may seek injunctive relief in Federal Court against any person discharging a pollutant in violation of the Act.

Salt Lake City Corporation—Department of Public Utilities

Several major acts have been passed that provide specific federal protections and give Salt Lake City extra territorial jurisdiction over public lands in the Wasatch Range canyons of Salt Lake County. The U.S. Congress passed acts in 1914 [Public Law 63-299] and in 1934 [Public Law 259] to set these lands aside to protect them from all mineral location, entry, or appropriation in order to protect water quality for the municipal water supply of Salt Lake City. Notably, specific wording is given to provide for cooperation between the U.S. Forest Service and Salt Lake City in managing these lands primarily for municipal water supply purposes. In turn, the Utah State Constitution provides extra territorial jurisdiction for Salt Lake City as a city of the first class to enact and enforce regulations to protect its water supply [UCA §10-8-15]. The Salt Lake City "Watershed Ordinance," [SLC §17.02-04] regulates construction and recreation activities in the protected watershed areas of Salt Lake County to prevent pollution of the water supply.

NOTE: The 1990 U.S. Congress Public Law 101-634 Salt Lake City Watershed Improvement Act signed by President George Bush, Sr. affirmed the 1914 & 1934 acts and allowed for USFS/SLC land exchange. However, the land exchange portion of the act was dropped from consideration by Mayor Corradini May 28, 1996 due in part to the expensive and burdensome USFS requirement that the City provide title insurance for all City lands transferred to the USFS.

Non-profit Organizations

Trout Unlimited

Trout Unlimited (TU) is a national conservation group dedicated to the mission to conserve, protect, and restore North America's trout and salmon fisheries and their watersheds. TU is a private non-profit organization with over 100,000 members in 450 chapters nationwide.

TU's interest and purpose in participating on the committee preparing the mining component of the 319 Clean Water Act regulations for the State of Utah, centers on a recently announced program area for our organization. This new program area is <u>Restoration of Abandoned Mine Sites.</u> TU is undertaking efforts to:

- Raise public awareness of the adverse impacts resulting from abandoned, or orphaned, hard rock mining operations in watersheds throughout the western United States.
- Explore and develop partnerships beginning at the grass roots level pressing for restoration actions at specific sites that are polluting aquatic habitats and limiting fish productivity.
- Demonstrate economical methods appropriate for remedial actions at selected mine sites acceptable to land owners while complying with state and Federal agencies' procedures and regulations.

The North Fork of American Fork Canyon, Utah has been selected as a watershed where restoration actions on private properties will be pursued by TU to compliment the mine restoration efforts previously completed by the Forest Service on National Forest System lands in this canyon. This project will be used by TU as a demonstration of how partners can work cooperatively and collaboratively in restoring abandoned mine lands to productive sites while reducing the potential, and ongoing, releases of hazardous substances into the adjacent environment. Our efforts will demonstrate the need for an ongoing program at the state and Federal levels dedicated to selecting and funding restoration efforts at abandoned mine lands to compliment and expand the meager, yet sincere, efforts underway by state, Federal, and private entities.

As the largest fishery conservation group in the nation, Trout Unlimited will exercise its prestige and influence to raise concerns, solicit partners, secure funding, and implement restoration actions at abandoned mine lands and to influence legislators to support these efforts with legislation protecting and encouraging Good Samaritan efforts in this regard. We recognize the mining component of the 319 Clean Water Act for Utah, and add our support to the effort of preparing those regulations, as a piece of the solution that will further this effort in this state.

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http://www.tuutah.org

VIII. MONITORING AND EVALUATION

There are two levels of monitoring and evaluation of NPS projects. One aspect is focused on the contribution a project makes towards accomplishing the greater goal of improving water quality throughout the State. The other aspect pertains to the individual project goals and if they were achieved. It is often difficult to evaluate the impacts of NPS mining projects on a wide geographic basis because the majority of individual problem sites appear in clusters in historic mining areas. Also, highly mineralized mining areas often have high levels of contamination resulting from the natural processes of weathering and erosion. Consequently, it is often not possible to isolate the impacts of an individual reclamation project site. With adequate characterization before remediation, however, there should be sufficient information to evaluate the accomplishment of goals. In addition to water quality data, other parameters for evaluation may include monitoring the health of associated biota, sedimentation and aesthetic appeal of a disturbed area.

Figure 55. Completed pond and slope revegetation of Alta Fen project.

Figure 56. Columbus-Rexall drainage acid mine drainage, Alta, UT.

IX. INFORMATION NEEDS AND STRATEGIES

New technologies and existing best management practices for inactive mines are presently being developed and tested in demonstration projects. Because of the diversity of the problems related to abandoned mines, the solutions are technologically complex and vary according to the specific characteristics of the site. The educational element of the mining committee's goals are focused on raising public awareness of the impacts that acid rock drainage and mine waste have on water quality and disseminating information about successful reclamation techniques to targeted groups such as landowners, mining companies, associations and local governments.

X. REFERENCES

Acid Rock Drainage at Enviromine. Website created by Chris Mills and Andy Robertson in May, 1997. Retrieved November 24, 2004 from http://technology.infomine.com/enviromine/ard/home.htm.

American Society for Mining and Reclamation (ASMR) (n.d.). Retrieved November 24, 2004 from http://ces.ca.uky.edu/asmr/Annual%20Conferences.htm.

American Water Resources Association (n.d.). Retrieved November 24, 2004 from www.awra.org/index.html and www.awra.org/proceedings/proceedings.html.

Buck, Stuart and David Gerard, 2001, Cleaning Up Mining Waste. Political Economy Research Center Research Study 01-1, November 2001 [01/05/05] http://www.perc.org/pdf/rs01_1.pdf

Colorado Department of Natural Resources, Division of Minerals and Geology. 2002, Best Practices in Abandoned Mine Land Reclamation: The Remediation of Past Mining Practices.

Colorado Department of Public Health and the Environment, Water Quality Control Division. 2000, Colorado Nonpoint Source Assessment Report.

Comprehensive Environmental Response, Compensation, and Liability (CERCLA), August 1989, EPA/9234.1-02.

Daly, Chris and Taylor, George. 2000. Spatial Climate Analysis Service 1961-1990. Accessed 2004 at http://nationalatlas.gov/atlasftp.html

Doelling, Hellmut H. and Edwin W. Tooker, 1983, Utah Mining District Areas and Principal Metal Occurrences, Map 70, Utah Geological Survey, Salt Lake City.

Durkin, Thomas V. and Jonathan G. Herrmann, 1994, Focusing on the Problem of Mining Wastes: An Introduction to Acid Mine Drainage, EPA Seminar Publication no. EPA/625/R-95/007 "Managing Environmental Problems at Inactive and Abandoned Metals Mine Sites" [01/05/05] http://technology.infomine.com/enviromine/publicat/amdintro.html

40 CFR Part 122, EPA Administered Permit Program: The National Pollutant Discharge Elimination System.

Grahame, John D. and Thomas D. Sisk, editors, 2002, Canyons, cultures and environmental change: An introduction to the land-use history of the Colorado Plateau. [01/05/05] http://www.cpluhna.nau.edu/.

High Altitude Revegetation Committee, Department of Soil and Crop Sciences Colorado State University, Fort Collins, CO (n.d.). Retrieved November 24, 2004 from www.highaltitudereveg.com.

Hintze, Lehi F., Grant C. Willis, Denise Y.M. Laes, Douglas A. Sprinkel, and Kent D. Brown, 2000, Digital Geologic Map of Utah, Map 179DM, Utah Geological Survey, Salt Lake City.

International Conference on Acid Rock Drainage (ICARD) (n.d.). Retrieved November 24, 2004 from http://www.inap.com.au/Icard.htm.

Journal of the American Water Resources Association, American Water Resources Association (n.d.). Retrieved November 24, 2004 from www.awra.org/jawra/index.html.

*Land and Water: The Magazine of Natural Resource Management and Restoration (*n.d.). Retrieved November 24, 2004 from www.landandwater.com.

Loomis, John B. 2002. Integrated Public Lands Management: Principles and Applications to National Forests, Parks, Wildlife Refuges, and BLM Lands. Columbia University Press

Milligan, Mark R. (Jan 2000). How was Utah's topography formed? Survey Notes 32(1) Retrieved from http://geology.utah.gov/surveynotes/gladasked/gladtopoform.htm.

National Association of Abandoned Mine Land Programs (NAAMLP) (n.d.). Retrieved November 24, 2004 from www.onenet.net/~naamlp/.

Reclamation Research Unit, Montana State University - Bozeman (n.d.). Retrieved November 24, 2004 from www.montana.edu/reclamation/publications.htm.

Spatial Climate Analysis Service. 2000. Retrieved November 24, 2004 from http://www.ocs.orst.edu/prism/

Sprinkel, Douglas A., 1999, Digital Geologic Resources Atlas of Utah, Bulletin 129DF, Utah Geological Survey, Salt Lake City, March.

Stokes, William Lee, 1986, Geology of Utah, Utah Museum and Natural History and Utah Geological and Mineral Survey Occasional Paper No. 6, Salt Lake City. 258 pages.

USDA Forest Service, Wasatch-Cache National Forest. 2001, Ski Area BMPs (Best Management Practices): Guidelines for Planning, Erosion Control, and Reclamation.

Utah Department of Natural Resources, Division of Oil, Gas & Mining. 2000, The Practical Guide to Reclamation in Utah.

Utah Division of Environmental Response and Remediation. (n.d.) Retrieved February 1, 2005 from http://www.environmentalresponse.utah.gov/vcp/.

Utah Division of Oil Gas and Mining. (n.d.) Retrieved November 24, 2004 from http://dogm.nr.state.ut.us.

United States Geological Survey (USGS). (n.d.) Retrieved December 27, 2004 from http://water.usgs.gov/pubs/circ/circ1157/nawqa91.e.html

Utah Mining Association. (n.d.). Retrieved November 24, 2004 from http://www.utahmining.org/.

XI. GLOSSARY OF TERMS

303(d) List
The 303(d) list delineates impaired waterbodies in the State and is compiled by the Utah Department of Environmental Quality, Division of Water Quality every two years. This compilation is in accordance with Section 303(d) of the Clean Water Act and "is required to identify those waterbodies for which existing pollution controls are not stringent enough to implement state water quality standards." Once the waterbody has been identified as impaired, the State is required to assess the source (s) and to "allocate the responsibility for controlling the pollution." This process is called a Total Maximum Daily Load (TMDL) analysis.

305(b) Report
"Section 305(b) of the Clean Water Act requires each State to prepare a biennial report on the quality of its waters. A 305(b) report describes the extent to which streams, lakes, and estuaries support their designated uses. The report also identifies the pollutants or stressors causing impairment of designated uses and the sources of these stressors (e.g., wastewater treatment plants or mines). Ground water programs and impacts are also described. Rather than presenting raw monitoring data, a 305(b) report presents the results of careful assessment of those data in terms meaningful to the public and governing bodies (e.g., Tribal Councils, legislators). EPA transmits the individual 305(b) reports to Congress along with a summary report on the Nation's water quality prepared using the 305(b) information." [http://www.epa.gov/volunteer/305btribal.pdf]

319 Grant
In 1987, the US Congress amended the Clean Water Act (CWA) to establish the section 319 Nonpoint Source Management Program. Under this program, State, Territories, and Indian Tribes may receive grant money to conduct NPS assessment and cleanup activities. In addition, "technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects" are all supported by section 319 funds. [http://www.epa.gov/owow/nps/cwact.html]

Abandoned Mine
An abandoned mine is defined as a mine that has permanently ceased operation and is no longer producing. Government agencies generally interpret "abandoned" as referring to mines that ceased operations before there were state or federal laws requiring reclamation, so there is no identifiable private party responsible for reclamation and no private resources available to pay for reclamation.

Acid Mine Drainage (AMD)
Acidic water flowing from a mine. See "Acid Rock Drainage."

Acid Rock Drainage (ARD)
Acidic water formed when surface water or shallow groundwater reacts with rock containing sulfide minerals such as pyrite and air to form sulfuric acid. Acid rock drainage can be a problem because the acid leaches heavy metals from mineralized rock and keeps the metals in solution. Acid rock drainage is a more general term than acid mine drainage, since acidic waters have sources other than mines, but both terms are frequently used interchangeably. Both terms are frequently referred to by their acronyms, ARD and AMD.

XI GLOSSARY OF TERMS—Continued

Active Mine
A mine that is operating and producing ore, or temporarily idle with the intent to resume production. Active mines are regulated under state and federal law and are required to be reclaimed at the close of operations.

Adit
A horizontal entry or passage to an underground mine; a mine portal or drift. (In common usage, adits are often called shafts or tunnels, but strictly speaking, shafts are vertical and tunnels go completely through a hill and have two openings.)

Alkalinity
Alkalinity refers to the acid-neutralizing capacity of a solution. Alkalinity indicates how much change in pH will occur with the addition of moderate amounts of acid. [water.usgs.gov/pubs/ofr/ofr00-213/manual_eng/glossary.html]

AMD
See "Acid Mine Drainage"

Anoxic
Devoid or deficient in oxygen; anaerobic. Anoxic conditions are required for some acid rock drainage treatment technologies to function properly.

Aquatic Life
Any species of plant or animal life, whether living or dead, which at any stage in its life history, must inhabit water.

ARD
See "Acid Rock Drainage"

Beneficial Uses
In Utah, the State Water Quality Board designates beneficial uses. Examples of beneficial use designations include: “raw water source for domestic water systems; in-stream recreational use; swimming, boating, and water skiing; use by aquatic wildlife; use by cold and warm water fish; use by waterfowl and other water-oriented wildlife; and agricultural uses”. Therefore, each stream (or stream segment) in the State is classified or designated under one or more of these beneficial uses. It is unlawful for any person to discharge or place any wastes or other substances into a stream or lake that may interfere with a beneficial use for which a stream is designated (Utah Water Quality Board, 1988).

Best Management Practices (BMPs)
Techniques that have been proven to effectively reduce environmental degradation. BMP's have evolved over time and have been refined with use into standardized methods that produce reliable outcomes.

BMP
See "Best Management Practices".

XI GLOSSARY OF TERMS—Continued

Bog
A wetland receiving water and nutrients only from atmospheric inputs, dominated by sphagnum mosses and ericaceous shrubs, and characterized by low nutrient and oxygen availability, high acidity, and peat accumulation. (www.dnr.state.wi.us/org/land/er/publications/cw/Glossary.asp)

CERCLA
The Comprehensive Emergency Response, Compensation, and Liability Act, P.L/U.S.C. 42(103). This federal law is often called the Superfund Law because it established the "Superfund" to clean up sites contaminated with toxic wastes.

Clean Water Act (CWA)
The Clean Water Act (CWA), formerly known as the Federal Water Pollution Control Act, intended to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Section 101). To accomplish that objective, the act aimed to attain a level of water quality that "provides for the protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water." The CWA has five main elements: (1) a system of minimum national effluent standards for each industry, (2) water quality standards, (3) a discharge permit program that translates these standards into enforceable limits, (4) provisions for special problems such as toxic chemicals and oil spills, and (5) a revolving construction loan program (formerly a grant program) for publicly-owned treatment works (POTWs).

Colloids
Colloids are ultra-fine solid particles that are suspended in water. In contrast to larger sediment particles that are suspended in the water column by the motion of water and will eventually settle out when the water velocity drops, colloids are suspended by Brownian motion and will not settle out by gravity.

Comprehensive Emergency Response, Compensation, and Liability Act (CERCLA)
See "CERCLA".

Culinary
Used for human consumption. These waters are often referred to as “potable”.

CWA
See "Clean Water Act"

Drinking Water Source Protection Plan
A plan formulated by community drinking water providers and administered by the Utah Division of Drinking Water to identify potential contamination sources and protect the drinking water from those sources.

Erosion
Erosion is the displacement of soils by wind, water, ice, or movement in response to gravity.

XI GLOSSARY OF TERMS—Continued

Fen
A fen is a peat accumulating wetland that receives some drainage from surrounding mineral soils and usually supports marsh-like vegetation. These areas are richer in nutrients and less acidic than bogs. The soils under fens are peat (Histosols) if the fen has been present for a while. (www.soils.org/sssagloss/cgi-bin/gloss_search.cgi)

Geographic Information System (GIS)
A computer-aided system for the analysis and display of spatial data; at its simplest, a map linked to a database. GIS is a useful tool for nonpoint source pollution control because nonpoint problems can cover large geographic areas and because treatment requires the analysis of complex data from many disciplines. GIS facilitates the interpretation of the data and enhances understanding of causes and solutions.

Geomorphology
The branch of geology that studies the evolution and formation of landforms. Geomorphological principles can be applied to the design of constructed stream channels to improve long term stability.

Geotextile/Geomembrane
Sheets of synthetic fabric or plastic designed to have specific engineering properties (e.g. puncture strength, permeability). They are used as alternatives to or in conjunction with natural construction materials such as clay, gravel, or stone. Among other things, they are used as liners in repositories to isolate contaminated materials, as bedding under rock riprap to prevent scour and undercutting, and in silt fences as filters to capture sediments from runoff.

GIS
See "Geographic Information System"

"Good Samaritan" Legislation
Proposed Federal legislation intended to facilitate the good faith clean-up of contaminated sites by landowners or third parties by reducing the risk of legal and financial liability they might incur for doing so as potentially responsible parties under CERCLA.

Grant Reporting and Tracking System (GRTS)
Recipients of funds awarded under Section 319 are required by law to provide data and grant status information to the EPA. The Grant Reporting and Tracking System is a system by which grant recipient may report on: performance/milestone accomplishment, slippage, data collected, cooperation with State agencies, and suggestions for future work.

GRTS
See "Grant Reporting and Tracking System".

Headwater Streams
Small creeks at the uppermost end of a stream system, often found in the mountains, that contribute to larger creeks and rivers. (www.epa.gov/adopt/patch/html/glossary.html)

XI GLOSSARY OF TERMS—Continued

Heavy Metals
A group of metals with relatively high density or atomic weight, including lead, mercury, cadmium, zinc, and nickel, noted for their toxicity.

Hydrologic
Having to do with the properties, distribution, and/or circulation of water.

Inactive Mine
A mine that has temporarily or permanently ceased operation and is not producing; a mine that is neither active nor abandoned. "Inactive" is an imprecise term, but it is often used in reference to mines that ceased operation after there were state or federal laws in place requiring reclamation. Government agencies often interpret "inactive" to mean mines for which there is an identifiable legally responsible party with either an intent to resume mining at a later date or the capability and intent to commence reclamation (e.g. reclamation bond and plan). See "Abandoned Mine"

Mill
A machine or facility where ore or rock is crushed or ground for processing and extraction of metals.

Mine Dump
Waste rock, uneconomic ore, spoil, or refuse produced by a mine and usually discarded in a pile on the surface immediately outside the mine. (In common usage, mine dumps are often called tailings piles, but tailings are, strictly speaking, mill wastes.)

Nonpoint Source (NPS)
A source of pollution that cannot be traced to a discrete "point" location such as discharge from a pipe. An example of a nonpoint source of water pollution is runoff from agricultural fields, which can carry pesticides, fertilizer, and eroded soil into streams.

NPS
See "Nonpoint Source"

Ore
A natural mineral aggregate, especially one that is mined to extract minerals. (www.science.org.au/nova/027/027glo.htm)

Oxidize
A chemical reaction in which the reference element or compound losses electrons to another "reduced" element or compound- usually to oxygen (a powerful electron attractor). Oxidation typically results in the breaking up of complex compounds. (www.nps.gov/plants/restore/library/glossary.htm)

pH
A scale to measure the acidity of a solution, ranging from 0 (acidic) to 14 (basic), with 7 indicating a neutral solution. Most natural waters supporting life have a pH in the 6.5 to 9.0 range. Waters with a pH below 6.5 or above 9.0 are generally considered polluted. (The technical definition of pH is the negative logarithm of the hydrogen ion concentration.)

XI GLOSSARY OF TERMS—Continued

Potentially Responsible Party (PRP)
An individual or entity identified as participating in or contributing to the creation of a contaminated site on the Superfund list. PRP's can be held legally liable for recovering the costs of remediating the site under CERCLA. See "CERCLA".

Precipitate
A substance separated from a solution or suspension by chemical or physical change. (www.epa.gov/OCEPAterms/pterms.html)

PRP
See "Potentially Responsible Party"

QAP
See "Quality Assurance Plan"

QA/QC
Quality Assurance/Quality Control. Refers to procedures used to ensure consistent standards of quality in data or products. QA occurs during planning; QC checks results during execution.

Quality Assurance Plan (QAP)
A set of protocols designed to assure that uniform procedures are followed in the collection, handling, storage, and processing of field samples.

Radioactive
A property of certain elements, or isotopes of an element, whose atomic nuclei are unstable and subject to spontaneous disintegration. These materials give off ionizing radiation. (nuclear.bfn.org/glossary.htm)

Reclamation
The act of rehabilitating disturbed lands, such as mine sites, back to productive purposes; the restoration of disturbed lands to their pre-disturbance condition.

Remediation
A term used in this document in its general sense of a treatment or process to eliminate a problem (such as burying contaminated mine wastes), but also having specific meanings under CERCLA. Remediation can be synonymous with reclamation, but it usually has a connotation of cleaning up toxic or hazardous materials.

Re-vegetation
The establishment of plants on disturbed lands where the previous plant cover has been destroyed.

Runoff
That part of precipitation, snowmelt, or irrigation water that runs off the land into streams or other surface water. (library.marist.edu/diglib/EnvSci/archives/hudsmgmt/ny-njharborestuaryprogram/glossary.html)

XI GLOSSARY OF TERMS—continued

Sampling and Analysis Plan (SAP)
A plan specifying the logistics, personnel responsibilities, and procedures for a field sampling and data collection effort.

SAP
See "Sampling and Analysis Plan"

Sediment
Solid material, primarily soil particles, that is displaced and moved by water and deposited at another location. Sediment can be a form of water pollution while suspended in the water column.

Shaft
A vertical or steeply inclined entry to an underground mine; a vertical excavation. See "Adit".

Shale
Shale is a fine-grained sedimentary rock whose original constituents were clays or muds. It is characterized by thin laminae breaking with an irregular curving fracture, often splintery, and parallel to the often indistinguishable bedding planes. Non-fissile rocks of similar composition but made of particles smaller than 1/16 mm are mudstones. Rocks with similar particle sizes but with less clay and therefore grittier are siltstones. (www.en.wikipedia.org/wiki/Shales)

Silt
Silt is very fine soil sediment—usually < 1/16 mm.

Subsoiling
Breaking up compacted or hardpan soils with a ripper or similar implement to improve aeration and drainage.

Superfund
A federal program created by CERCLA to clean up contaminated sites. See "CERCLA".

Synoptic Tracer-Injection Studies
The methodology uses the injection of saline or bromide solution into the Creek headwaters, followed by intensive sampling of downstream water columns (equal width integrated sampling technique). The principal advantage to this method is that it provides an accurate estimation of pollutant load sources and entrance location to the target creek segment.

Tailings/Tails
Waste rock remaining after ore has been processed in a mill. Because the source material is ore that has been crushed (milled) for beneficiation, mill tailings tend to have finer textures and higher metal concentrations than the waste rock in mine dumps. See "Mine Dump".

Total Maximum Daily Load (TMDL)
A total maximum daily load (TMDL) is the total amount of pollutant that can be allowed into the water and still meet water quality standards.

XI GLOSSARY OF TERMS—Continued

Thiobacillus ferrooxidans
A type of bacterium that oxidizes sulfur produce energy. This sulfur-based bacterial respiration is thought to accelerate the chemical reactions that create acid rock drainage. Some acid rock drainage control techniques work by inhibiting the bacteria and thus slowing the creation of acid.

TMDL
See "Total Maximum Daily Load".

Turbidity
The measure of the scattering effect that suspended solids have on light; the higher the intensity of scattered light, the higher the turbidity. (water.usgs.gov/pubs/ofr/ofr00-213/manual_eng/glossary.html)

UAC
See "Utah Administrative Code"

UCA
See "Utah Code Annotated"

Unified Watershed Assessment
Implementation of the Utah Watershed Approach began in 1994 with the start of five year rotations of basin intensive monitoring surveys. This document includes a statewide schedule for and a description of the watershed planning and implementation process. The purpose is to provide agencies and local watershed stakeholders with the information they will need to become involved in the Watershed Approach process. DWQ will be using this plan/document for internal guidance to conduct their programs. Guidance to citizens and DWQ for water quality activities will be consistent. DWQ, as the state water quality agency, expects participation from all federal partners, which will lead to enhanced federal consistency.

Use Attainability Analysis
Analysis that describes factors limiting designated use of waterbodies. (www.epa.gov/waterscience/biocriteria/glossary.html)

Utah Administrative Code (UAC)
The published compilation of regulations promulgated by state agencies to carry out Utah law.

Utah Code Annotated (UCA)
The published compilation of laws passed by the Utah legislature.

Watershed
The land above a given point on a waterway that contributes runoff water to the flow at that point; a drainage basin or a major subdivision of a drainage basin. (www.water.utah.gov/waterplan/uwrpff/Glossary.htm)

XI GLOSSARY OF TERMS—Continued

X-Ray Fluorescence Studies
In X-ray fluorescence (XRF) a material is exposed to X-rays with a relatively high energy. These photons are capable of exciting (ejecting) the electrons in the core levels of the material under investigation. The induced excited state relaxes under emission of an X-ray photon with a smaller energy. This emitted light is analyzed in a spectrometer. Because the core levels have very different energies for different elements the XRF spectrum contains information on the elemental composition of the material. (www.en.wikipedia.org/wiki/X-ray_fluorescence)

Yellow Boy
Vernacular term for deposits of iron hydroxide on stream banks and beds as a result of acid rock drainage. The deposits coat rocks and other surfaces and range in color from yellow to orange to rusty. They are an easily identified sign of acid rock drainage.

Appendix A
Utah Division of Oil, Gas and Mining Abandoned Mine Inventory

County	*Number of Map Symbols Plotted by USGS* *NOTE 1*	*AMRP Inventory: NONCOAL* *NOTE 2*	*AMRP Inventory: COAL* *NOTE 2*
Beaver	**1247**	551	0
Box Elder	**423**	97	0
Cache	**26**	0	0
Carbon	**106**	0	609
Daggett	**17**	0	0
Davis	**8**	14	0
Duchesne	**45**	46	2
Emery	**225**	405	217
Garfield	**210**	112	19
Grand	**310**	200	39
Iron	**222**	92	95
Juab	**1755**	230	0
Kane	**21**	0	72
Millard	**316**	33	0
Morgan	**32**	0	4
Piute	**361**	213	0
Rich	**37**	43	0
Salt Lake	**56**	464	0
San Juan	**688**	684	0
Sanpeate	**4**	**0**	**21**
Sevier	**201**	37	27
Summit	**8**	24	221
Tooele	**1149**	1890	0
Uintah	**168**	13	131
Utah	**828**	175	0
Wasatch	**9**	66	0
Washington	**147**	652	0
Wayne	**15**	6	0
Weber	**18**	0	0
TOTAL	**8652**	**6047**	**1457**

APPENDIX A—Continued
Utah Division of Oil, Gas and Mining Abandoned Mine Inventory

Data from the Abandoned Mine Reclamation Program (AMRP) in the Utah Division of Oil, Gas and Mining. (January 2005)

Note 1:
Number of mine symbols (shafts, adits, prospects, pits) plotted on the USGS 7.5' 1:24,000 scale topographic map series. This symbol count excludes certain AMRP project areas where reclamation has been completed. Because the symbols do not indicate mine status, some active mines may be included in the count. This count includes symbols for both coal and noncoal mines.

Note 2:
Number of abandoned mine features inventoried to date by the AMRP. Mine features primarily mean shafts, adits, prospects, trenches, and pits, but may include structures, coal refuse piles, waste rock dumps, and other non-excavated features. This count includes features listed in the AMRP database plus recently inventoried features not yet entered into the database. The numbers only reflect completed field inventory efforts—a comprehensive statewide inventory has not been completed. *This is not an estimate of the total number of mines that may exist in a county.*

Appendix B
Selected Water Quality Standards
Utah Administration Code R317-2; Effective March 1, 2004

Parameters for Aquatic Life Standards

	3A	3B	3C	3D
PHYSICAL				
Total Dissolved Gases	(1)	(1)		
Minimum Dissolved Oxygen (MG/L) (2)				
30 Day Average	6.5	5.5	5.0	5.0
7 Day Average	9.5/5.0	6.0/4.0		
1 Day Average	8.0/4.0	5.0/3.0	3.0	3.0
Max. Temperature(C)(3)	20	27	27	
Max. Temperature Change (C)(3)	2	4	4	
pH (Range)	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0
Turbidity Increase (NTU)	10	10	15	15
METALS (4) (DISSOLVED, UG/L)(5)				
Aluminum				
4 Day Average (6)	87	87	87	87
1 Hour Average	750	750	750	750
Arsenic (Trivalent)				
4 Day Average	150	150	150	150
1 Hour Average	340	340	340	340
Cadmium (7)				
4 Day Average	0.25	0.25	0.25	0.25
1 Hour Average	2.0	2.0	2.0	2.0
Chromium (Hexavalent)				
4 Day Average	11	11	11	11
1 Hour Average	16	16	16	16
Chromium (Trivalent) (7)				
4 Day Average	74	74	74	74
1 Hour Average	570	570	570	570

Copper (7)				
4 Day Average	9	9	9	9
1 Hour Average	13	13	13	13
Cyanide (Free)				
4 Day Average	5.2	5.2	5.2	
1 Hour Average	22	22	22	22
Iron (Maximum)	1000	1000	1000	1000
Lead (7)				
4 Day Average	2.5	2.5	2.5	2.5
1 Hour Average	65	65	65	65
Mercury				
4 Day Average	0.012	0.012	0.012	0.012
1 Hour Average	2.4	2.4	2.4	2.4
Nickel (7)				
4 Day Average	52	52	52	52
1 Hour Average	468	468	468	468
Selenium				
4 Day Average	4.6	4.6	4.6	4.6
1 Hour Average	18.4	18.4	18.4	18.4
Silver				
1 Hour Average (7)	1.6	1.6	1.6	1.6
Zinc (7)				
4 Day Average	120	120	120	120
1 Hour Average	120	120	120	120
INORGANICS (MG/L) (4)				
Total Ammonia as N (9)				
30 Day Average	(9a)	(9a)		
1 Hour Average	(9b)	(9b)	(9b)	(9b)
Chlorine (Total Residual)				
4 Day Average	0.011	0.011	0.011	0.011
1 Hour Average	0.019	0.019	0.019	0.019
Hydrogen Sulfide (13) (Undissociated, Max. UG/L)	2.0	2.0	2.0	2.0
Phenol (Maximum)	0.01	0.01	0.01	0.01

RADIOLOGICAL (MAXIMUM pCi/L)				
Gross Alpha (10)	15	15	15	15
ORGANICS (UG/L) (4)				
Aldrin				
1 Hour Average	1.5	1.5	1.5	1.5
Chlordane				
4 Day Average	0.0043	0.0043	0.0043	0.0043
1 Hour Average	1.2	1.2	1.2	1.2
4,4' -DDT				
4 Day Average	0.0010	0.0010	0.0010	0.0010
1 Hour Average	0.55	0.55	0.55	0.55
Dieldrin				
4 Day Average	0.056	0.056	0.056	0.056
1 Hour Average	0.24	0.24	0.24	0.24
Alpha-Endosulfan				
4 Day Average	0.056	0.056	0.056	0.056
1 Hour Average	0.11	0.11	0.11	0.11
beta-Endosulfan				
4 Day Average	0.056	0.056	0.056	0.056
1 Day Average	0.11	0.11	0.11	0.11
Endrin				
4 Day Average	0.036	0.036	0.036	0.036
1 Hour Average	0.086	0.086	0.086	0.086
Heptachlor				
4 Day Average	0.0038	0.0038	0.0038	0.0038
1 Hour Average	0.26	0.26	0.26	0.26
Heptachlor epoxide				
4 Day Average	0.0038	0.0038	0.0038	0.0038
1 Hour Average	0.26	0.26	0.26	0.26
Hexachlorocyclohexane (Lindane)				
4 Day Average	0.08	0.08	0.08	0.08
1 Hour Average	1.0	1.0	1.0	1.0
Methoxychlor (Maximum)	0.03	0.03	0.03	0.03
Mirex (Maximum)	0.001	0.001	0.001	0.001

Parathion				
4 Day Average	0.013	0.013	0.013	0.013
1 Hour Average	0.066	0.066	0.066	0.066
PCB's				
4 Day Average	0.014	0.014	0.014	0.014
Pentachlorophenol (11)				
4 Day Average	15	15	15	15
1 Hour Average	19	19	19	19
Toxaphene				
4 Day Average	0.0002	0.0002	0.0002	0.0002
1 Hour Average	0.73	0.73	0.73	0.73
POLLUTION				
INDICATORS (11)				
Gross Beta (pCi/L)	50	50	50	50
BOD (MG/L)	5	5	5	5
Nitrate as N (MG/L)	4	4	4	
Total Phosphorus as P (MG/L) (12)	0.05			

Agricultural and Recreational Standards for Metals

Parameter	Domestic Source	Recreation and Aesthetics		Agriculture
	1C	2A	2B	4
BACTERIOLOGICAL (30-DAY GEOMETRIC MEAN) (NO.)/100 ML) (7)				
Max. Total Coliforms	5000	1000	5000	
Max. Fecal Coliforms	2000	200	200	
E. coli	206	126	206	
MAXIMUM (NO.)/100 ML) (7)				
E. coli	940	576	940	
PHYSICAL				
pH (RANGE)	6.5-9.0	6.5-9.0	6.5-9.0	6.5-9.0
Turbidity Increase (NTU)		10	10	
METALS (DISSOLVED, MAXIMUM MG/L) (2)				
Arsenic (Trivalent)	0.01			0.1
Barium	1.0			
Beryllium	<0.004			
Cadmium	0.01			0.01
Chromium	0.05			0.10
Copper				0.2
Lead	[0.05] 0.015			0.1
Mercury	0.002			
Selenium	0.05			0.05
Silver	0.05			
INORGANICS (MAXIMUM MG/L)				
Bromate	0.01			
Boron				0.75
Chlorite	<1.0			
Fluoride (3)	1.4-2.4			
Nitrates as N	10			

Total Dissolved Solids (4)	Irrigation			1200
	Stock Watering			2000
RADIOLOGICAL (MAXIMUM pCi/L)				
Gross Alpha	15			15
Gross Beta	4 mrem/yr			
Radium 226, 228 (Combined)	5			
Strontium 90	8			
Tritium	20000			
Uranium	30			
ORGANICS (MAXIMUM UG/L)				
Chlorophenoxy Herbicides				
2,4-D	[100] 70			
2,4,5-TP	10			
Methoxychlor	[100] 40			
POLLUTION INDICATORS (5)				
[Gross Beta (pCi/L)	50			50]
BOD (MG/L)		5	5	5
Nitrate as N (MG/L)		4	4	
Total Phosphorus as P (MG/L)(6)		0.05	0.05	

TEMP (C)	MG/L
12.0	2.4
12.1-14.6	2.2
14.7-17.6	2.0
17.7-21.4	1.8
21.5-26.2	1.6
26.3-32.5	1.4

Appendix C
Nonpoint Source Mining Plan
Technical Advisory Committee

Federal Agencies	State Agencies	Local Agencies	Non-governmental entities
Kris Jensen Carol Russell Steve Bubnick U.S. EPA Region 8 999 18th Street—Suite 300 Denver, CO 80202-2466 Phone: 303-312-6237 303-312-6310 303-312-6829 Jensen.kris@epamail.gov Russell.carol@epamail.gov Bubnick.steven@epamail.gov	Mary Ann Wright Mark Mesch Chris Rohrer Ken Wyatt Division of Oil, Gas and Mining P.O. Box 145801 Salt Lake City, UT 84114-5801 Phone: 801-538-5306 801-538-5349 801-538-5322 801-538-5266 maryannwright@utah.gov markmesch@utah.gov chrisrohrer@utah.gov kenwyatt@utah.gov	Steve Jensen Salt Lake County Public Works Department 2001 South State Street N-3100 Salt Lake City, UT 84190 Phone: 801-468-3630 sfjensen@co.slc.ut.us	David Litvin Utah Mining Association 136 South Main Street Salt Lake City, UT 84101-1672 Phone: 801-364-1874 mining@xmission.com
Terry Snyder BLM Utah State Office P.O. Box 45155 Salt Lake City, UT 84145 Phone: 801-539-4026 Terry_snyder@ut.blm.gov	Juliette Lucy, P.G. Utah Geological Survey P.O. Box 146100 Salt Lake City, UT 84114 Phone: 801-537-3347 juliettelucy@utah.gov	Tom Ward, Watershed Supt. Salt Lake City Public Utilities 1530 South West Temple Salt Lake City, UT 84115 Phone: 801-483-6768 Thomas.ward@slcgov.com	Ted Fitzgerald Trout Unlimited 1233 E. 420 S. Payson, UT 84651 Phone: 801-465-9949 tfitzgerald@tu.org
Martha Manderbach Mine Cleanup Program USDA-Forest Service-R4 324 25th Street Ogden, UT 84401 Phone: 801-625-5271 mmanderbach@fs.fed.us	Bill Bradwisch Division of Wildlife Resources P.O. Box 146301 Salt Lake City, UT 84114-6301 Phone: 801-538-4866 billbradwisch@utah.gov	Keith Hanson, General Manager Salt Lake County Service Area #3 P.O. Box 920067 Snowbird, UT 84092-0067 Phone: 801-278-9660 Sa3@xmission.com	Kerry Gee United Park City Mines P.O. Box 1450 Park City, UT 84060 Phone: 435-649-8011 kcgee@unitedpark.com

Nonpoint Source Mining Plan
Technical Advisory Committee Continued

Federal Agencies	State Agencies	Local Agencies	Non-governmental entities
Briant A. Kimball U.S. Geological Survey 2329 W. Orton Circle West Valley, UT 84119-2047 Phone: 801-907-5047 bkimball@usgs.gov	Mike Reichert Harry Judd Keith Eagan Division of Water Quality P.O. Box 144870 Salt Lake City, UT 84114 Phone: 801-538-6954 801-528-6057 801-538-6057 801-538-6017 mreichert@utah.gov hjudd@utah.gov keagan@utah.gov		Kelly Payne Kennecott Utah Copper P.O. Box 6001 Magna, UT 84044 Phone: 801-569-7128 Kelly.payne@kennecott.com
Charles Condrat, Hydrologist Wasatch-Cache National Forest 8436 Federal Building 125 South State Street Salt Lake City, UT 84138 Phone: 801-524-3939 ccondrat@fs.fed.us			Jim Baker Mountain Planning and Development Snowbird Ski Corporation P.O. Box 929000 Snowbird, UT 84092-9000 Phone: 801-521-6040 ext. 4132 jbaker@snowbird.com
			Al Tunbridge Alta Ski Lifts Corporation P.O. Box 8007 Alta, UT 84092 Phone: 801-799-2290 al@alta.com

Appendix D

Factors Contributing to Sampling Analysis Plans (SAP) and Quality Assurance Project Plans (QAPP)

It is essential that each abandoned mine restoration report include a Sampling Analysis (SAP) and Quality Assurance Plan (QAPP). The EPA has outlined elements of these plans in their QA/R-5 guidance report (http://www.epa.gov/quality/qs-docs/r5-final.pdf). Required elements outlined in the QA/R-5 guidance report include:

1. Title and approval sheet
2. Table of contents
3. Problem definition and background
4. Project/task description
5. Distribution list
6. Project/task organization
7. Special training/certification
8. Documents and records
9. Quality objectives and criteria
10. Sampling process design
11. Sampling methods
12. Sample handling and custody
13. Instrument/equipment calibration and frequency
14. Analytical methods
15. Data review, verification and validation
16. Verification and validation methods
17. Non-direct measurements
18. Data management
19. Quality control
20. Assessment and response actions
21. Instrument/equipment testing, inspection and maintenance
22. Reconciliation with user requirements
23. Assessment and response actions
24. Reports to management

In addition to QA/R-5 requirements, factors to be included in specific types of SAP and QAPP reports are listed below.

PLAN	FACTORS
Surface Water Sampling and Analysis Plan (SAP)	• Locations and descriptions of all stream and discharge sampling stations • Specification and acquisition of all supplies • Specification and acquisition of all testing and flow measuring equipment • Training and coordination of workers • Determination of timing for sampling events
Surface Water Quality Assurance Plan (QAP)	• Target analytes • Sample collection protocols • QA/QC Plan • Sample filtration techniques • Sample preservation and storage • Acidified bottle/cooler storage • Transport and retention time
Mine Waste Dump Sampling and Analysis Plan (SAP)	• Locations and descriptions of all sampled mine waste dumps and tailings • Accurate material volume estimates • Acquisition of supplies and equipment • Core sampling depth/location • Flow routing of surface runoff in/around dumps • Location of adits, tunnels, discharges
Mine Waste Quality Assurance Plan (QAP)	• Target analytes • Sample collection protocols such as mine • waste grab samples or integrated statistical • composite sampling • Sample preparation and storage • Testing techniques and methods that include leachate and saturated extract methods, and acidity/alkalinity determination • QA/QC plan • Scintillometer readings of mine wastes and offsite background materials • X-Ray Fluoresence (XRF) readings of heavy metals in soils
Mine/Groundwater Sampling and Analysis Plan (SAP)	• Target analytes • Monitoring well installation locations • Background groundwater quality such as mine-pool water quality and flow paths and contaminated plume locations • Well design specifications • Well sampling procedures • Tracer study locations and design of program • Fluorescent dye tracing • Ionic tracer methods • Injection and recovery sampling locations • Fate and transport modeling • Isotopic study design and procedures • Identification of appropriate isotopes • Geochemical “fingerprinting” water sources

Notably, Mine/Groundwater Quality Assurance Plans (QAP) have the same requirements as stream and mine drainage characterization.

APPENDIX E

Users Guide for Utah CWA 319 Water Quality Project Proposals

Utah Department of Environmental Quality, Division of Water Quality, annually receives proposals to fund projects to use Clean Water Act (CWA) funding to improve, protect, restore, or study water quality in the waters of the State of Utah through reducing or preventing nonpoint source pollutant loading to those waters.

Project proposals must be developed using official EPA format and guidance. Proposals should be requested early from and submitted via email to *randfisher@utah.gov* by August 1 each year, or by the last Friday in July if August 1 is on a weekend.

If 319 project materials are requested, participants will be emailed documents to be used in developing project proposals that will likely include:

Evaluation Criteria for NPS 319 Project Proposals

Environmental Protection Agency Region 8 Non-Point Source Program Project Sponsors Project Proposal Guidance for FY 2000 and Beyond

Comments, Guidance, Adjustments to EPA Region 8 document

State of Utah Guidance For Sampling and Analysis Plans/Quality Assurance Project Plans (QAPPs)

The US Office of Management and Budget looks very closely to achieve measurable improvement to water quality from 319 projects. Plans and procedures to appropriately measure and/or model any changes in water quality resulting from the project should be detailed in the QAPP.

In addition to the materials listed above, those with interest in proposing a project for funding should review http://www.waterquality.utah.gov/watersheds/state.htm to determine status and nature of existing TMDLs, Watershed Plans, and other relevant watershed information. Projects addressing existing or proposed TMDLS will be favored for funding.

EPA requires that CWA 319 projects address water quality problems that are included in the state water quality plan. That plan for several years focused on agricultural factors. But new, additional components to the Utah State Water Quality Management Plan are being adopted. It is anticipated the first of these will be the plan for Management of Abandoned Mines and Mine Wastes. Review the Utah Water Quality website http://waterquality.utah.gov/documents/DOC_RULE.HTM to determine if this plan has been adopted and to insure your project proposal compatibly integrates with and supports the statewide plan. With expansion in the types of water quality projects that are eligible for consideration, competition for the limited funding is intense. In developing project proposals, consult early with watershed councils, watershed coordinators, and other appropriate management offices and impacted parties to facilitate inclusion of appropriate objectives, projects, and management practices in the project proposal.

APPENDIX F
Main areas of consideration when evaluating mining-related proposals

The three main areas of consideration for evaluating mining-related proposals are:

1. **Basic threshold requirements -** This is a broad evaluation to determine if the proposal fits the overall objective of the nonpoint source program. Surface water and groundwater projects will be considered and the project should target water bodies on the State's 303(d) list; with an approved TMDL; or surface or ground waters that are significantly threatened with impairment. The project should directly reduce or prevent non-point source pollution.
2. **Magnitude, feasibility, monitoring, and cost effectiveness of the proposal –** The project is evaluated in regard to the severity and extent of the problem; the technical and financial feasibility; monitoring and evaluation of the project; and demonstration value for other areas of the State. An important factor that will be considered is whether Drinking Water Source Protection Plans, administered by the Utah Division of Drinking Water have identified the NPS pollution as a potential source of contamination. Higher consideration is given to projects that have a comprehensive, multi-disciplinary approach to non-point source management including cooperation and coordination with other programs; demonstrates quality technical information relating to the link between problem and solution including capability of best management practices and other management measures to attain a defined water quality endpoint; have appropriate quantitative monitoring; and will show innovative and cost effective solutions to the problem.
3. **Overall priority and importance of the project –** This evaluates the project in regards to how comprehensive the project is. For example, higher consideration will be given to projects that address nonpoint source pollution problems at the watershed scale than at a single project site within the watershed.

APPENDIX G

Contact Information for Utah's Watershed Coordinators

Name	***Affiliation***	***Address***	***City, State, Zip***	***Email***	***Phone***
Ann Marie Aubry	BLM, Moab Field Office	82 East Dogwood	Moab, UT 84532	Ann_Marie_Aubry@ut.blm.gov	(435) 259-2173
Roger Barton	San Rafael SCD	PO Box 263	Ferron, UT 84523-0263		(435) 384-2397
Dwayne Bradshaw	Beaver River	P.O. Box 482	Beaver, UT 84713		(435) 438-5683
Lee Broadbent	NRCS Coalville	PO Box 526	Coalville, UT 84017	lee.broadbent@ut.usda.gov	
Melvin Brooks	Canyonlands SCD	P.O. Box 243	Escalante, UT 84726		(435) 826-4252
Alan Brown	Tri-Valley Watershed	3021 South 2900 West	Charleston, UT 84032		(435) 654-0423
George Burbidge	Weber County	444 24th Street	Ogden, UT 84401-1502	gburbidg@co.weber.ut.us	(801) 399-8677
Jim Carter	Friends of Strawberry Valley	735 Labrum Ave.	Murray, UT 84107	jim@strawberryanglers.com	(801) 269-0619
George Carter	Moab SCD	2941 E. Bench Rd	Moab, UT 84532	geoann@citlink.net	(435) 259-1413
Corey Cram	Washington County WCD	136 N. 100 E. Suite 1	St. George UT 84770	ccram@utah.gov	(435) 438-5683
Randy Crozier	Duchesne Co. WCD	855 E 200 North (112-10)	Roosevelt, UT 84066	dcwcd@ubtanet.com	(435) 722-4977
Wally Dodds	Upper Sevier River	P.O. Box 77	Panguitch, UT 84759	wally-dodds@ut.nacdnet.org	(435) 676-1155
Lee Duncan	2210 S. Hwy 40 Suite B	P.O. Box 87	Heber City, UT 84032	lee.duncan@ut.nacdnet.net	(435) 654-3861
Darrell Eddington	Morgan County Courthouse	48 W. Young St.	Morgan, UT 84050	darrelle@ext.usu.edu	(801) 845-4026
Merlin Esplin	Kane County	P.O. Box 48	Orderville, UT 84758		(435) 648-2109
Sheridan Hansen	Washington County WCD	136 North 100 East	St. George, UT 84770		(435) 673-4971
Spencer Hardman	Deep Creek Watershed	6082 Hardman Lane	Ibapah, UT 84034		(435) 234-1179
Cloyd Harrison	Ashley Creek	7592 S 3200 West	Spanish Fork, UT 84660		(801) 794-3529
Allen Henrie	Upper Sevier River	P.O. Box 128	Panguitch, UT 84759	allenhenrie@yahoo.com	(435) 676-8585
Catherine Howells	Castle Valley Water Agent	HC 64 P.O. Box 3706	Castle Valley, UT 84532	chowells@frontiernet.net	(435) 259-1908
Dennis Gunn	Coalville City	10 North Main P.O. Box 188	Coalville, UT 84017	dennismgunn@yahoo.com	(435)-336-2571
Steve Jensen	Salt Lake County Engineering	2001 S State St N3100	Salt Lake City, UT 84190	SFJensen@slco.org	(801) 468-3630

APPENDIX G

Contact Information for Utah's Watershed Coordinators—Continued

Michael Johnson	Grand County Extension Agent		Moab, UT 84532		
Bruce Karren	North Cache SCD	20 East 1600 South	Lewiston, UT 84320	sbkarren@mtwest.net	(435) 258-2828
Joe Larsen	Newton Creek Watershed	PO Box 94	Newton UT 84327	joeglarsen8@aol.com	(801) 563-5667
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Ray Loveless	Mountainland AoG	586 East 800 North	Orem, UT 84097-4146	rloveless@mountainland.org	(801) 229-3838
Dale Mathis	Price River SCD	2699 East Hwy 6	Price UT 84501		(435) 637-7610
Pam Mitchell	Ogden Valley Watershed	7149 East 1000 North	Huntsville, UT 84317	pam@ovba.org	(801) 745-4506
Jay Olsen	San Pitch River	2600 N Old Highway 89	Ephraim, UT 84627	keskoranch@mail.manti.com	(435) 283-4376
Scott Paxman	Weber Basin WCD	2837 E Hwy 193	Layton, UT 84040	spaxman@weberbasin.com	(801) 771-1677
Ann Peralta	Middle Bear / Cutler Reservoir Watershed	522 N 350 East	Hyde Park, UT 84318-3353	awperalta@comcast.net	(435) 563-0356
Dale Pierson	Mill Creek Watershed	1910 Spanish Valley Dr.	Moab, UT 84532	gwssa.dale@frontiernet.net	(435) 259-8121
Bart Powaukee	Ute Tribe Water Quality	PO Box 190	Ft. Duchesne, UT 84026	waterquality@ubtanet.com	(435) 725-3320
Denee Rex	Woodruff Creek Watershed	1590 Little Crawford Rd	Woodruff, UT 84086	drex@allwest.net	(435) 793-4181
Jay Sagers	Clover Creek Watershed	90 South West Park	Rush Valley, UT 84069		(435) 837-2244
Jeff Salt	Great Salt Lake Keeper	PO Box 520867	Salt Lake City, UT 84154	jeff-salt@greatsaltlakekeeper.org	(801) 485-2550
Richard Saunders	Timp-Nebo SCD	4083 W. 12680 S.	Payson, UT 84651	slownold@bugoyne.com	(801) 465-2777
Fred Selman	Malad River Watershed	PO Box 175	Tremonton, UT 84337	fselman@citilink.net	(435) 257-7201
Karen Smart	Alpine SCD	4313 N. 900 W.	Pleasant Grove, UT 84062		(801) 785-6358
Penny Trinca	Bear River Watershed	1860 North 100 East	Logan, UT 84341	Penny.Trinca@ut.nacdnet.net	(435) 753-6029 x.30
Monte Turner	Sevier River	P.O. Box 803	Richfield, UT 84701	monte.turner@ut.nacdnet.org	(435) 896-8965
Jon White	Little Bear River Watershed	PO Box 46	Paradise UT 84328	Brookeranch@aol.com	(435) 245-3707
Stanley Wood	Fremont River SCD	392 N 110 W	Lyman, UT 84749		(435) 836-2772
Jeff Young	Ensign Ranches	P.O. Box 1845	Evanston, WY 82931	kjyoung@vcn.com	(435) 289-8414

APPENDIX H
List of Acronyms

NAME	ACRONYM
Abandoned Mine Land	AML
Abandoned Mine Reclamation Program	AMRP
Acid Mine Drainage	AMD
Acid Rock Drainage	ARD
Administrative Orders on Consent	AOC
All Terrain Vehicle	ATV
American Society for Mining and Reclamation	ASMR
Best Management Practices	BMP
Clean Water Act	CWA
Coal Regulatory Program	CRP
Code of Federal Regulation	CFR
Comprehensive Environmental Response Compensation and Liability Act	CERCLA
Federal Insecticide, Fungicide, and Rodenticide Act	FIFRA
Geographic Information System	GIS
Hazardous Material	HAZMAT
International Conference on Acid Rock Drainage	ICARD
Maximum Contaminant Level	MCL
Memorandum of Understanding	MOU
Mine Regulatory Program	MRP
National Association of Abandoned Mine Land Program	NAAMLP
National Environmental Policy Act	NEPA
National Forest Service	NFS
National Oil and Hazardous Substance Pollution Contingency Plan	NCP
National Priority List	NPL
Nonpoint Source	NPS
Potentially Responsible Party	PRP

APPENDIX H—Continued
List of Acronyms

NAME	ACRONYM
Quality Assurance Project Plan	QAPP
Resource Conservation Recovery Act	RERA
Safe Drinking Water Act	SDWA
Sampling Analysis Plan	SAP
Technical Advisory Committee	TAC
Total Dissolved Solids	TDS
Total Maximum Daily Load	TMDL
Toxic Substance Control Act	TSCA
Underground Injection Control	UIC
United States Department of Agriculture	USDA
United States Environmental Protection Agency	EPA
United States Office of Surface Mining	OSM
Use Attainability Analysis	UAA
Utah Administrative Code	UAC
Utah Department of Environmental Quality	DEQ
Utah Division of Environmental Response and Remediation	UDERR
Utah Division of Oil, Gas and Mining	DOGM
Utah Pollution Discharge Elimination System	UPDES
Voluntary Environmental Cleanup Program	VCP
Water Quality Act	WQA

APPENDIX I

Sites of Most Pressing Concern in Utah

The following is a list of known sites exhibiting severe impacts from abandoned mine related concerns. Although, it is generally accepted that Silver Creek, Little Cottonwood, and Mineral Basin in American Fork Canyon are the top priorities for clean-up, the remaining sites are listed in no particular order.

SITE	COUNTY
Silver Creek	Summit
Little Cottonwood	Salt Lake
American Fork Canyon (Mineral Basin)	Utah
Atlas Tailings	Grand
La Sal Creek	San Juan
Fry Canyon	San Juan
Cottonwood Wash	San Juan
Red Canyon	San Juan
White Canyon	San Juan
Lisbon Valley	San Juan
Tintic Mountains	Juab/Utah
Sheeprock Mountains	Tooele
Drum Mountains	Juab/Millard
Mineral Mountains	Beaver
Antelope Range	Iron
Silver Reef	Washington